Final Report

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Human Skeletal and Dental Remains from Four Sites on Tinian and Saipan, Commonwealth of the Northern Mariana Islands

by

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Table of Contents

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List of Tables

List of Tables (cont'd)

List of Plates

Introduction

This report describes human skeletal and dental remains excavated at four sites in the Northern Mariana Islands, which were sent to the Department of Anthropology, University of Hawaii, for study.

Three sites are located on the island of Saipan; San Antonio, Grotto, and the Marianas High School sites. The other site, Tinian Latte House site, is located on the island of Tinian. Individual burials were identified for all the sites except San Antonio. The San Antonio site contains the disarticulated remains of at least thirty-three individuals secondarily intured in a common grave and one extended burial.

The report includes a discussion of the laboratory and statistical methods utilized, detailed descriptions of the human remains from the four sites, conclusions, samples sent for radiocarbon dating, references cited, and numerous tables which summarize the metrical and non-metrical observations recorded on these remains. Included in the descriptions are the minimum number of individuals represented, completeness and preservation of the remains, age and sex, estimates of stature, summaries of metric and non-metric observations of cranial, dental, and infracranial remains, pathology, and a notation of the non-human and cultural material found in association with the human remains. Photographic plates illustrate some of the morphological variation and pathology described in the report. ork A , work was undertaken by the principal investigator (M.P.) and one anthropology graduate assistant (C.B.) at the Department of Anthropology, University of Hawaii-Manoa, between October, 1979 and May, 1980.

Methods

Sorting, cleaning, reconstruction, cataloguing

The material was received in a single crate, the remains from each of the four sites, however, being individually wrapped and identified. The material from each site was unpacked and studied separately, retaining when possible, any possible associations these assemblages might convey.

All of the remains were first cleaned by washing them in cold water, removing adhering soil and other encrustations. Many of the San Antonio remains were encrusted with a sanstone-like matrix which required the use of a dental pick. Where possible, bones contained in a separate bag were cleaned as a unit to retain any possible associations of bones and fragments of bones. Non-human material (including cultural remains) were separated from the osseous and dental remains.

After drying, the Tinian Latte House, Marianas High School, and Saipan Grotto remains were sorted, as permitted, into individual skeletons, replacing, where necessary, teeth which had fallen out and reconstructing fragmented bones.

The San Antonio remains were sorted into cranial, including both complete skulls and individual skull bones, and infracranial bones. Where possible, these usually fragmentary remains were reconstructed and assigned consecutive burial numbers for each bone category. A count of the minimum number of individuals represented by each bone type was then determined. For paired bones, the side with the highest number was used for the minimal count. An epoxy resin was used to reconstruct fragmented remains. Finally, the remains were labelled by assigning a number and site identification code. The site identification code (abbreviations) are defined at the bottom of Table 4.

Age and sex determination

Age and sex of the individuals were determined from osseous and dental features following techniques described by Anderson (1969), Brothwell (1963), and Krogman (1962). Because of the fragmentary and sometimes incomplete nature of the remains, as many different criteria as possible were utilized. Ages of subadult individuals were determined primarily from states of tooth eruption and epiphyseal closure. Estimates of adult ages were based mainly on dental attrition, and general cranial suture closure. Because of the inexactness of the estimations of adult ages and the predominantly Western standards upon which these estimates are based, only a rough categorizing into young, middle-aged, and old-aged groups was attempted. The sex of subadults was not determined. Determinations of sex of adult remains relied on various diagnostic criteria of skull, innominate bones, and long bones. For the San Antonio material, only the sex of skulls and some of the long bones was attempted.

Data collection

Cranial measurements recorded in this study are presented in Table 1. The measurements recorded on the infracranial remains are listed in Table 2. Sliding and spreading calipers and a wooden measuring board were used to record all cranial and infracranial measurements. Bucco-lingual (BL) and mesio-distal (MD) tooth crown diameters were recorded to the nearest millimeter using dial Helios Calipers (pointed tips) according to methods described in Moorrees (1957:80).

A list of the non-metric cranial observations recorded on these remains is given in Table 3. These, and non-metric observations recorded on dental and infracranial remains are described by Pietrusewsky (1969a, 1969b).

Stature estimates using lengths of complete bones were based on formulae for Mongoloid populations provided in Trotter & Gleser (1958). Stature estimates based on fragments of long bones follow procedures described in Steele & McKern (1969).

Pathology

Pathology of bone and teeth was noted where applicable.

Degenerative changes or osteoarthritis of the articular surfaces of the major long bones were recorded on an absence, slight, moderate, and marked basis reflecting the severity of arthritic involvement observed. Degenerative changes of the articular surfaces of presacral vertebrae were similarly recorded.

Statistical analysis

Statistical analyses (means and standard deviations of continuous data, and tests of significance) were performed using a IBM 370 computer and a Texas Instrument (TI-59) programmable calculator.

Tinian Latte House (TLH) Site

The human skeletal material from this site, located on the island of Tinian, was excavated from shallow pits cut into limestone bedrock within a traditional Latte structure according to information provided by the excavators.

Although the excavators' report lists only two separate burials for this site, the remains of four additional individuals were found when the remains were sorted in the laboratory, thus indicating that at least six individuals are represented at this site. Each individual will be described separately. Included in these descriptions are the age and sex of the

individual, completeness and preservation of the remains, a summary of some of the salient metrical and non-metrical characteristics of dental and osseous remains, and any pathology. Tables which record the detailed metric and non-metric observations accompany these descriptions.

Burial TLH-1

A middle-aged female (35-40 yrs.) represented by a skull and partially complete infracranial skeleton. Long bone representation includes all the major bones of the upper and lower limbs (missing hand and foot skeletons), rib fragments, and four cervical vertebrae. Bone preservation is excellent. Skull and long bones show lesions attributable to yaws. The latter will be described in more detail in a later section.

Cranial measurements and indices

Skull measurements recorded on TLH-1 are presented in Table 4. Cranial indices and cranial capacity are given in the following table, Table 5.

The shape of the skull, as indicated by the cranial index value, is mesocranic, or of average breadth in relation to length. Values calculated for the height-length and height-breadth indices indicate the skull is high in relation to both length (hypsicranic) and breadth (acrocranic) dimensions. The calculated value obtained for the frontal index indicates a broad (eurymetopic) forehead. The gnathic index value indicates a prognathic face. Eye orbits are mesoconch, or of average breadth in relation to height. The shape of the nasal aperture is mesorrhine, or of average breadth and height dimensions. The palate is brachyuranic, or broad. Cranial capacity for this individual is estimated to be 1286.6 cc.

Non-metric cranial observations

Non-metric cranial observations recorded on the adult specimens from the Tinian Latte House site are presented in Table 6. Some of the salient non-metric cranial features of the TLH-1 skull are illustrated in Plates 1 through 3 of the report.

Female characteristics of this skull include frontal bossing, little or no brow ridge development, and gracile facial construction. The shape of the eye orbits is ellipsoid. The nasal aperture is pyriform in shape with a sharp subnasal margin. Paramastoid processes were observed on both the right and left sides. The occiput took the form of a mound with transverse ridging and inion development. Slight tympanic thickening is present bilaterally. The rocker jaw condition, or the propensity of the lower jaw to rock when deflected from a resting position on a level surface was present to a limited degree in the mandible. The form of the chin is pointed medially and bilaterally with an angularity rising inferiorly at the symphysis menti (median-bilateral angle condition).

Dental observations

Tooth measurements recorded on TLH-1 are presented in Table 7.

The following non-metric observations recorded on the teeth of TLH-1 are worth mentioning. The teeth are darkly stained; probably due to the chewing of betel-nut. The mandibular molar cusp pattern is +4 for the right second molar and Y4 for the left second molar. Considerable tooth wear, extending into the dentine, was observed. Extensive caries, absessing and resorption of the alveolus bone surrounding the teeth are present. Both maxillary third molars are impacted and

PLATE 1.

Tinian Latte House Burial-1
(Middle-aged Female)

Frontal view of cranium showing two treponemal-like (yaws) lesions in the mid-frontal region. A trace of the metopic suture is persistent in the glabella region of this skull. The nasal-frontal junction is omega-shaped; the nasal suture deflects to the right on meeting the frontal bone; the right infraorbital foramen is double. Betel-nut staining of the teeth is evident. Anterior teeth have fallen out after the death of this individual.

PLATE 1.

PLATE 2.

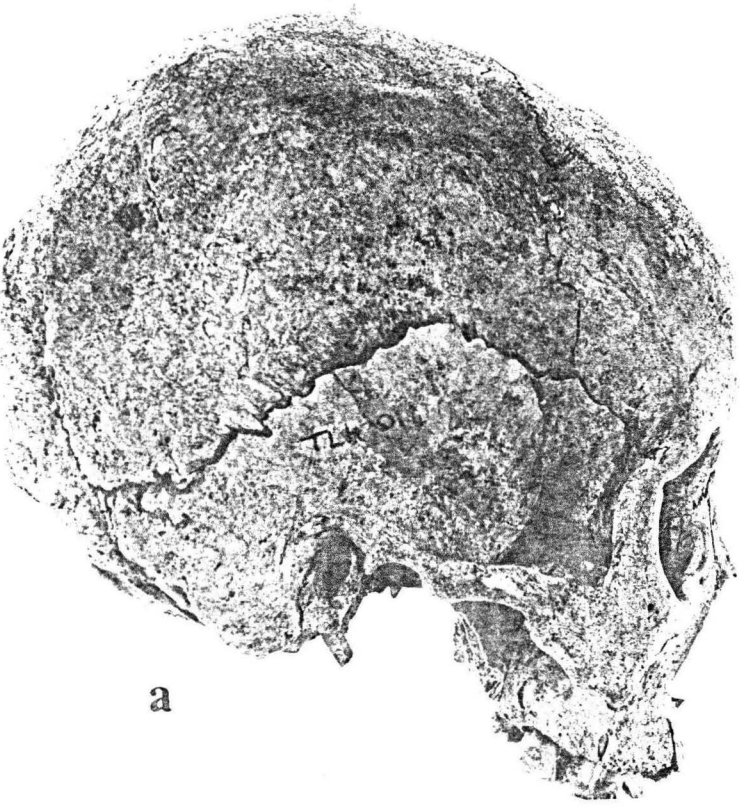
Cranium of TLH-1 (Tinian)
(Middle-aged Female)

A. Lateral (right) view showing frontal bossing, absence of brow ridge development, H-form pterion, and thickening of the tympanic plate. Note the gracile features of the vault.

B. Superior view. Note the well rounded contour and absence of coronal and sagittal wormian bones. Yaws-like lesions are barely visible in the forehead region.

C. Posterior view. The shape of the skull is haus-form; transverse ridging is evident in the occiput region. A large single parietal foramen penetrates the sagittal suture.

D. Basal view of cranium.



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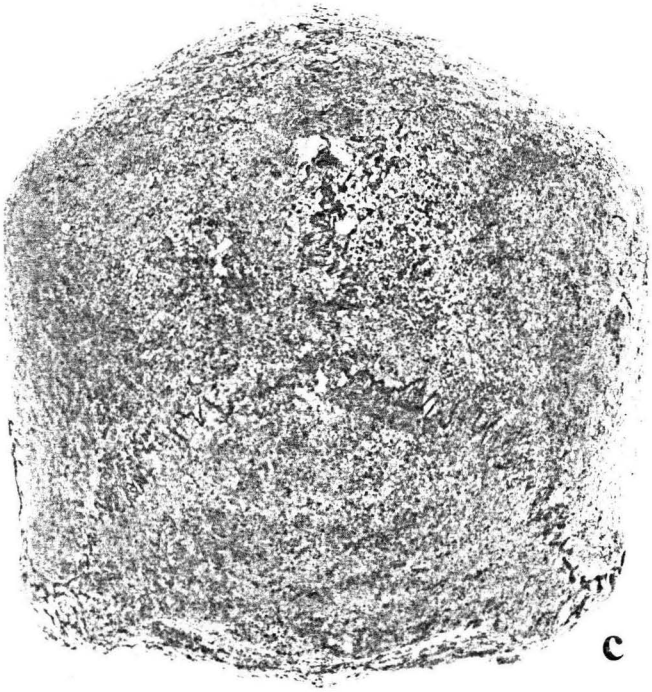

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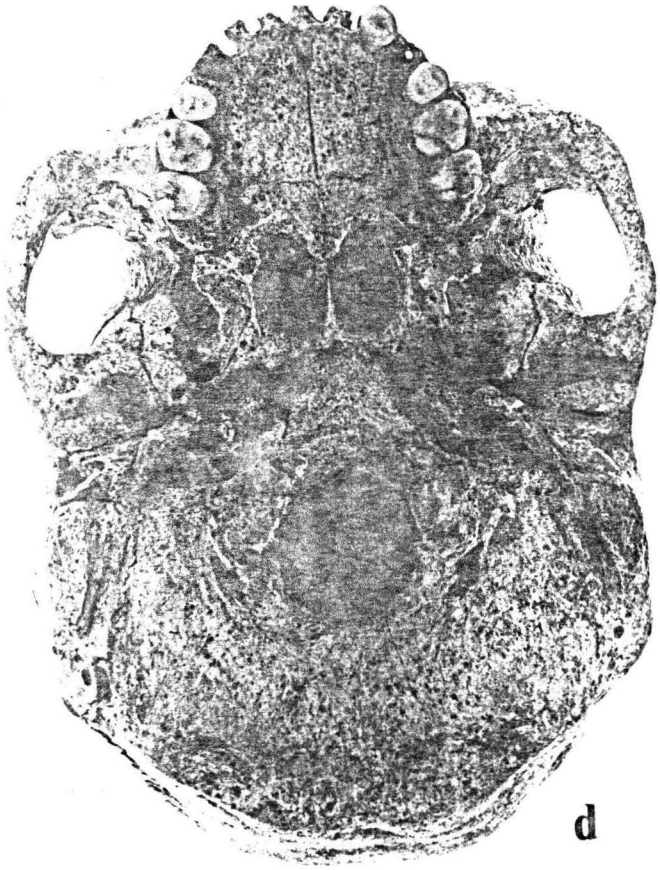

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PLATE 2.

PLATE 3.

Tinian Latte House Burial 1.
(Middle-aged Female)

Mandible showing excessive dental wear, destructive caries (especially in the crown-neck region), abcessing, and extensive resorption of the alveolar bone. This mandible also shows the slight 'rocker jaw' condition, allowing it to rock when deflected anteriorly from a resting position on a level surface.

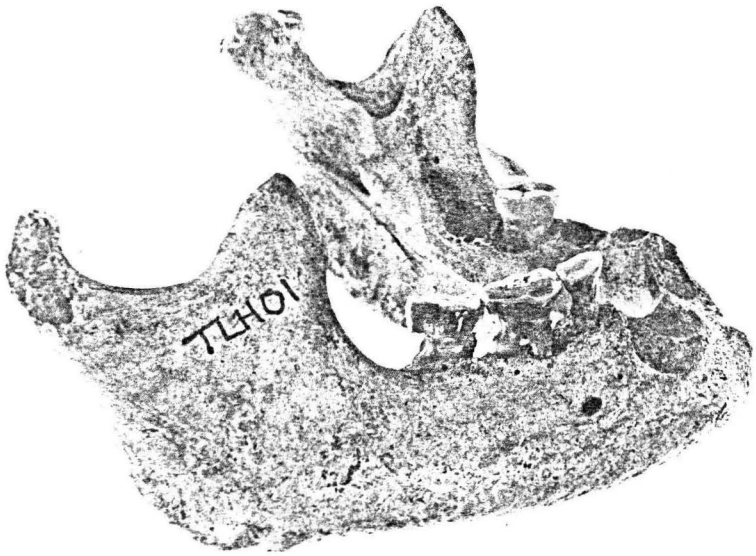

PLATE 3.

observed to be erupting from the sides of the maxillary alveolus superior and slightly distal to M2. Only two incisors were lost before the death of this individual. Roughly a third of the teeth are missing since the death of this individual.

Infracranial measurements and indices

Measurements and calculated indices of the infracranial remains of TLH-1 are presented in Table 9.

The platymeric index indicates platymeria or flattening of the femoral shaft at the subtrochanteric level. An index of the same measurements taken at mid-shaft (pilastric index) also indicates flattening of the femur. The platycnemic index falls into the eurycnemic range indicating no flattening of the tibial shaft at the level of the nutrient foramen. The presence of swelling of the tibial shaft due to treponemal infection, however, makes this latter value inaccurate.

The radio-humeral index indicates that the forearm is not proportionately longer than the upper arm. The intermembral index indicates long legs in proportion to arm length. The tibia-femur index indicates that the lower leg is not proportionately shorter than the upper leg. The stature of the individual is estimated to be 163.8 $\pm$ 3.24 cm.

Infracranial non-metric observations

Non-metric observations recorded on the infracranial remains of TLH-1 are presented in Table 10.

An acetabular notch is present in both innominates. The gluteal tuberosity is present as a raised ridge on both femora. A squatting facet was observed on the lateral aspect of the neck of the left talus. A corresponding facet on the distal end of the left tibia was not observed.

Pathology of Burial TLH-1

> "...it has been assumed that yaws, but not syphilis, was present in the aboriginal Chamorro populations of these islands, as well as the rest of Micronesia at the time of discovery. However, since the rigors of Spanish rule resulted in near depopulation of the Marianas in early historical times, this disease could have been introduced or reintroduced there in the course of repopulation by Filipinos and other island natives. Judging by the history of other native communities, syphilis was carried to the Marianas by visiting European ships, but whether or not it became established in the native population is masked by its similarity to yaws. This timing is consistent with the belief, expressed above, that syphilis did not exist in this part of the world prior to the coming of the Spanish. On the basis of this reasoning any evidence of such a disease from pre-historic village sites would pertain to yaws." (Stewart & Spoehr, 1967: 308-309)

Burial TLH-1 found in association with the remains of a Latte House construction on the island of Saipan shows characteristic yaws-like lesions like those described in Stewart and Spoehr (1952) and Steinbock (1976). The absence of pre-contact trade goods and association with Latte House construction are consistent in identifying these remains as prehistoric and indigenous to the Mariana Islands. A description of the treponemal (yaws) lesions found in the cranial and infracranial remains of TLH-1 follows.

Skull

Macroscopic inspection of the skull (see Plate 1) reveals two crater-like lesions in the mid-frontal region. The lower placed lesion is nearly circular measuring 7 to 8 millimeters in diameter. The second lesion, just superior to the first, is more irregular in outline but with more distinct margins with its greatest diameter measuring approximately 7 mm. Neither lesion penetrates the inner table of the skull vault.

Classic invasive necrosis of the skull typical in syphilis is lacking. Osteoporosis, or fine pitting of the outer table of the vault is also evident in this specimen.

Long bones

The majority of the long bones show external thickening and swelling. The bones showing the most extreme thickening include the left ulna, radius, and humerus, right fibula, and both tibiae. The remaining long bones show less involvement; the right forearm and both femora being the least affected. The tibiae also show moderate degrees of bowing (saber-shin tibia) with several osseous lesions projecting from the tibial surfaces. Plates 4 and 5 illustrate the lesions described in the infracranial remains.

Burial TLH-2

A young adult female (21-22 yrs.) represented by a skull (with intact teeth) and substantially complete infracranial skeleton missing only the left radius, ulna and hand bones, left foot and the lower three lumbar vertebrae. Bone preservation is excellent.

Cranial measurements and indices

Skull measurements and calculated indices for TLH-2 are recorded in Tables 4 and 5 respectively.

The face was found to be slightly prognathic in profile. As was the case for TLH-1 the shape of the skull is mesocranic or of average breadth in relation to legnth. Likewise, the skull of TLH-2 is high in relation to length (hypsicranic) and breadth (acrocranic). The

PLATE 4.

Tinian Latte House Burial 1

Forelimb bones of TLH-1 showing swelling and curvature due to yaws. Bones from the left side, especially ulna, are more severely affected than those on the opposite side.

PLATE 4.

PLATE 5.

Tinian Latte House Burial 1

Lower leg bones (tibiae and fibulae) of TLH-1 showing typical yaws-like lesions. The distal end of the right fibula shows excessive swelling and distortion. Also evident are osteophytic nodules along the shafts of the tibiae (especially the left tibia) and saber-shin tibiae condition.

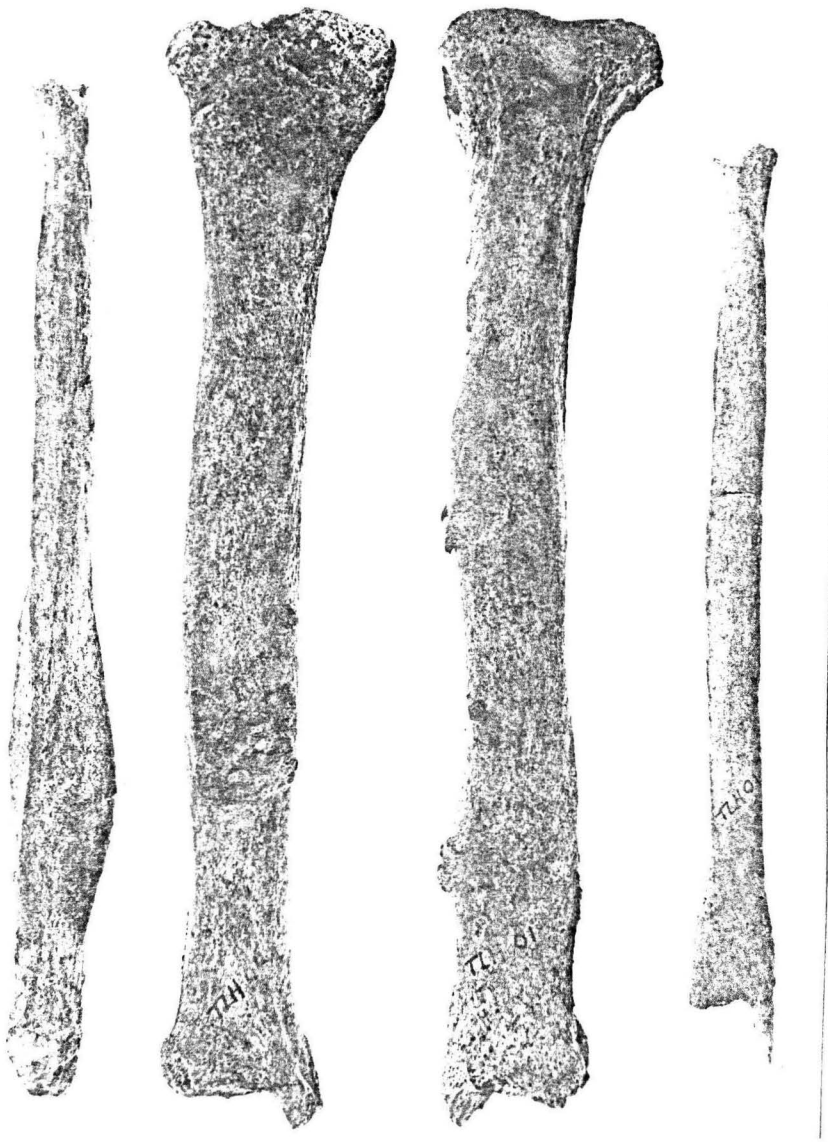

PLATE 5.

forehead is metriometopic, or of average frontal breadth in relation to cranial breadth. The cranial capacity is estimated to be 1296.2 cc.

The eye orbits are mesoconch or of average breadth in relation to height. The nasal aperture is leptorrhine or narrow in relation to height. The palate is brachyuranic or broad.

Non-metric cranial observations

Detailed non-metric observations recorded on the skull of TLH-2 are given in Table 6. Plates 6 and 7 show various views of the cranium for TLH-2 and illustrate some of the more salient features summarized here.

The skull is gracile with bilateral frontal bossing and lacks brow ridges. The shape of the eye orbits is equilateral. The shape of the nasal aperture is pyriform with a sharp subnasal margin. A bridging of the pterygo-plate is present on the right side. Paramastoid processes are present on both right and left sides. A slight depression is present along the sagittal suture. The occiput took the form of a mound and slight ridging. The rocker jaw condition is partially present in the mandible.

The skull appears heavy, but due to its complete nature, no vault thickness values are recorded in Table 8.

Dental observations

With the exception of one tooth, the dentition is complete. Tooth measurements are recorded in Table 7.

As was the case for the other substantially complete burial from this site, the teeth of TLH-2 are stained a dark reddish brown. The upper central incisors show slight shovelling. The molar cusp pattern

is +4 for the first mandibular molar, Y5 for the second molar and +4 for the third molar.

Dental attrition is slight affecting only the enamel. Evidence for peridontal disease is minimal. No caries or abcesses were observed.

Infracranial measurements and indices

A record of the infracranial measurements and indices for TLH-2 is presented in Table 9.

The platymeric index indicates eurymeria or the absence of flattening of the femoral shaft at the subtrochantric level. The pilastric index indicates no flattening of the mid-femur shaft. The platycnemic index falls into the eurycnemic range indicating the absence of flattening of the tibial shaft. The radio-humeral index indicates that the forearm is not proportionately longer than the upper arm while the intermembral index indicates long legs in proportion to arms. The tibia-femur index indicates that the lower leg is not proportionately shorter than the upper leg. The stature of the individual is estimated to be 163.5 ± 3.24 cm.

Infracranial non-metric observations

A costo-clavicular sulcus, or an anomalous ulcer-like condition of the site of attachment of the costo-clavicular ligament on the inferior, sternal end of the right clavicle, is present. Squatting facets on the anterior surface of the distal end of the tibiae are present. A similar squatting facet on the medial neck region of the trochlear surface of the right talus is also present. The anterior and middle articular facets of the right calcaneus took the form of two discrete facets.

PLATE 6.

Cranium TLH-2 (Tinian)
(Young Adult Female)

A. Frontal view. Nasal bones missing (damaged). Note supraorbital notch on right and left sides; single infraorbital foramina; and betel-nut staining on teeth.

B. Left lateral view. Frontal bossing, absence of brow ridges, and general gracile features are apparent in this young adult female. The pterion is H-form.

C. Superior view. Note premature closure (craniostenosis) of sagittal suture.

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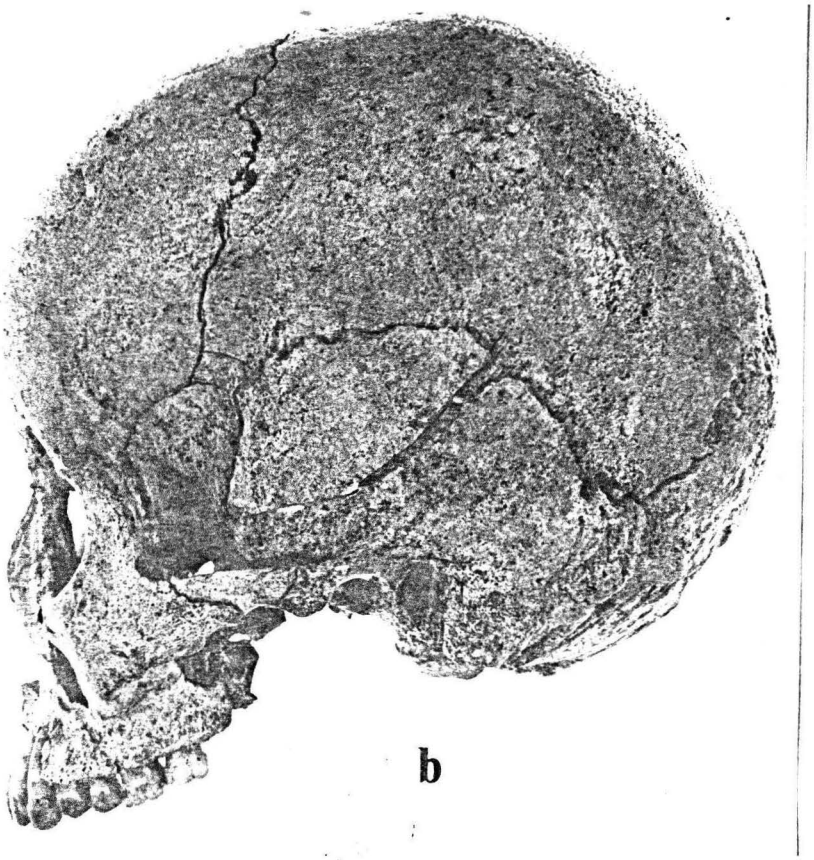

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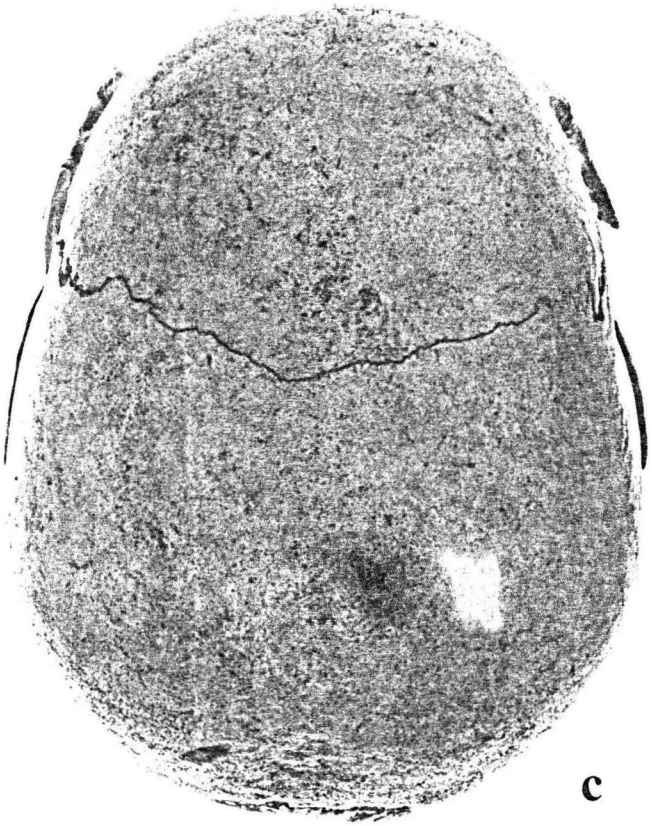

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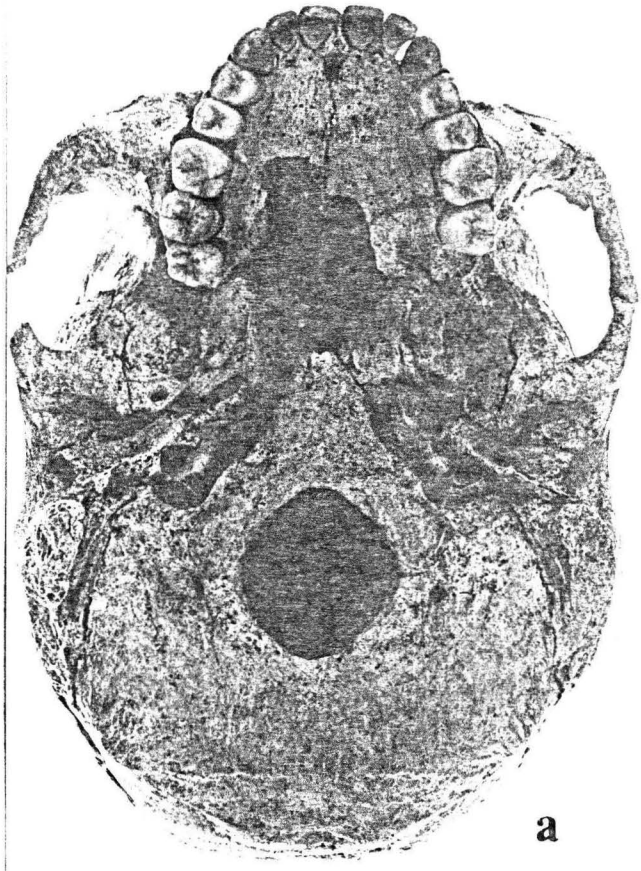
PLATE 6.

PLATE 7.

Cranium TLH-2 (Tinian)
(Young Adult Female)

A. Basal view. The right M3 is newly erupted; the left one is missing. There is incipient bridging of the pterygo-plate on the right side.

B. Posterior view. Note premature fusion of sagittal suture, parietal bossing, and absence of lambdoidal wormian bones.



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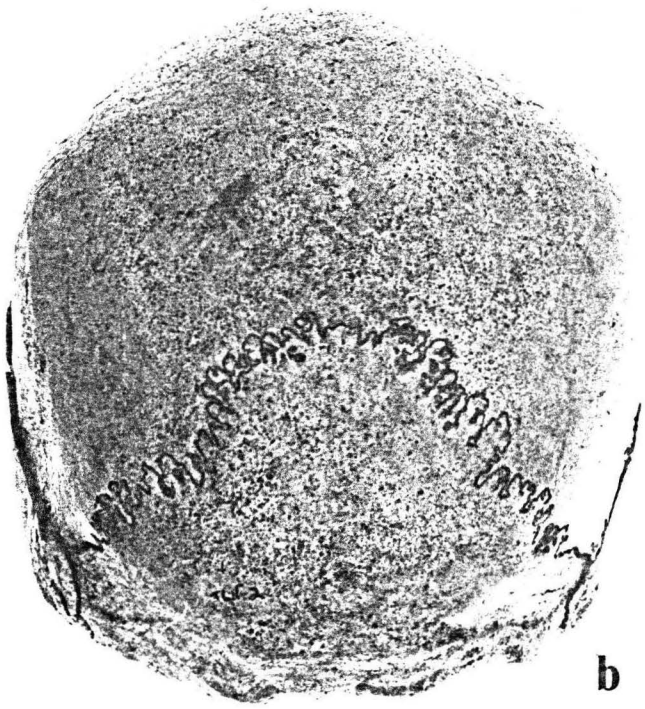

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PLATE 7.

Pathology

The articular surfaces of the long bones and vertebrae of this young individual are free of osteoarthritis or degeneration.

Burial TLH-3

A sub-adult female (12-14 yrs.) represented by a partially complete skull and infracranial skeleton. Infracranial remains consist of paired right and left clavicles, humeri, femora, patellae, hand bones, and fragments of the left forearm bones and the first cervical through second thoracic vertebrae. Bone preservation is fair. The extremities of some long bones are damaged and missing.

Non-metric cranial observations

Non-metric cranial observations for TLH-3 are recorded in Table 6. The skull lacks brow ridge development. Bilateral bossing is present. The shape of the eye orbits is equilateral. The occiput took the form of a mound. A parietal notch is present on the left side. Thickening of the tympanic plate was observed on the left side. The rocker jaw condition is present incipiently. A few cranial vault measurements are presented in Table 8 for this individual. They do not suggest irregular thickening when compared to some of the other specimens examined.

Dental observations

The maxillary second molars and the right mandibular second molar have not yet erupted. The upper central incisors show slight shovelling. The molar cusp pattern is Y4 for both the right and left mandibular first molars. Tooth staining was not observed. Dental attrition is slight. Tooth crowding in the incisor region was noted.

Infracranial non-metric observations

Non-metric observations recorded on the infracranial remains are reported in Table 10. Septal aperture is present in both humeri, the one right being double.

Pathology

None observed.

Burial TLH-4

An old adult female (+45 yrs.) represented by the right maxilla, mandible, and a substantially incomplete infracranial skeleton. Infracranial representation includes right and left humeri, left clavicle, fragments of ribs, vertebrae fragments, and the right talus. Bone preservation is poor; the proximal and distal extremities of the humeri and clavicle are damaged.

Non-metric cranial observations

The non-metrical observations recorded on the mandible are presented in Table 6. The rocker jaw condition is present incipiently.

Dental observations

Only one tooth was loss before death of this individual. Roughly one-fifth of the dentition have been loss since the death of the individual. The left third mandibular molar is congenitally absent. Tooth staining was not observed. Dental attrition is extreme reaching the root in some cases. Resorption of the alveolaris marg[illegible]s is marked. Both caries and abcessing are present.

Infracranial observations

Supratrochlear spurs on the humeri were not observed. Because of the limited nature of these remains, no other observations were recorded.

Pathology

No observations were possible.

Burial TLH-5

A child of approximately 5 years of age represented by a substantially complete mandible, maxilla, and some skull fragments. Deciduous teeth are present. Bone preservation is fair.

Burial TLH-6

An infant, approximately six months old, represented by fragments of left clavicle tibia, ribs, and vertebrae. Preservation is poor.

Non-human remains

No non-human remains were found in association with the human skeletal and dental remains from this site sent to Hawaii.

Marianas High School Site (Saipan)

This site was uncovered while trenches for tree planting were being dug. Medicine beads were found in association with the remains and local legend suggests that the individuals were from the Caroline Islands. Archaeological data, however, is inconclusive.

The site contains the skeletal remains of at least five individuals. A description of each individual according to its burial number, including the age and sex, completeness of the remains, preservation, and noteworthy metric and non-metric observations is given. Dental,

cranial, and infracranial observations for each of the individuals are summarized in Tables 4 through 10.

Burial MHS-1

An old adult female (+45 yrs.) represented by a cranium lacking facial bones, mandible, and a few infracranial bones. Bone representation from the left side includes the humerus, patella, talus, calcaneus, metatarsals 2-5, and from the right, femur and talus. Preservation is fair. The ends of some long bones were damaged or missing.

Cranial measurements and indices

Cranial measurements for MHS-1 are given in Table 4. The value obtained for the cranial index indicates the skull is mesocranic, or of average breadth in relation to length.

Non-metric cranial observations

Non-metric cranial observations for MHS-1 are presented in Table 5.

The skull is of gracile proportions lacking brow ridges. Frontal bossing is present. Frontal grooves are present on the right side. The vault when viewed posteriorly is haus-form. The occiput took the form of a mound with some ridge development. The parietal foramen is double on the right and single on the left. The rocker jaw condition is incipiently present.

Dental observations

The mandible is completely edentulous, all teeth were lost before death of the individual.

Infracranial observations

A few measurements recorded on the infracranial remains of this individual are presented in Table 9. Non-metrical observations recorded on the infracranial remains of MHS-1 are presented in Table 10. Squatting facets are present on both tali. The anterior and middle articular facets of the right calcaneus took the form of a single facet.

Pathology

Some cranial vault thickening is evident in the remains of MHS-1 as recorded in Table 8.

Burial MHS-2

A middle-aged male (30-35 yrs.) represented by a mandible, some cranial bone fragments, and a few infracranial bones including fragments of the right and left scapula, right clavicle, humerus, metatarsals 1, 3 and 4, and the cuboid bone. Bone preservation is poor.

Cranial observations

A few measurements recorded on the mandible fragment are given in Table 4.

Dental observations

Tooth measurements are presented in Table 7. Incisors of the mandibular dentition were lost before the death of this individual. A few teeth are also missing since the time of death. The teeth are stained from chewing betel-nut. Dental attrition is moderate exposing the dentine. Calculus build up and resorption of the alveolar portion of the mandible is moderate to marked and indicative of peridontal disease.

Infracranial observations

No measurements of the infracranial skeleton were recorded. Limited non-metrical observations are presented in Table 10.

Pathology

There is slight lipping of the glenoid cavity of the right scapula.

Burial MHS-3

A young adult female represented by the right half of a mandible (mostly intact dentition), and left cuboid bone. Bone preservation is poor.

Cranial observations

None were permitted.

Dental observations

Tooth measurements are presented in Table 7. Most of the mandibular dentition, with the exception of the incisors and left third molar, is present. The tooth enamel shows evidence of betel-nut staining. The molar cusp pattern on the right M1 and M2 is "+5." The right M3 cusp pattern is wrinkled. Slight to moderate dental attrition was observed. The dentine of the molar teeth is exposed.

Infracranial observations

None were permitted.

Pathology

No signs of arthritic lipping or degeneration were noted in these limited remains.

Burial MHS-4

A child of approximately 7-8 years of age represented by a few teeth, fragments of both clavicles and humeri, left scapula, and right ischium. Epiphyses of the right humerus and right femur are present. Preservation is poor.

Burial MHS-5

A child of approximately 2-4 years of age represented by deciduous teeth and fragments of ribs and vertebrae. Preservation is poor.

Non-human and cultural material

Cultural material included both prehistoric and historic remains such as sherds of a thick, red, coarse tempered pottery; some red spondylis shell beads; flakes of hematite and cert-like material; glass bottle sherds; pieces of deteriorated metal; and a metal nail. Shell and fish bone remains were also found among the human remains.

Grotto (Saipan Latte House) Site

This site, located on the north end of Saipan, was uncovered during the construction of a parking lot which destroyed a Latte House and partially exposed a burial. The fieldnotes indicate one individual was found face down in a shallow pit with another skull placed above its own. The lower legs and feet were missing. The burial was covered with a number of large pottery sherds which appeared to be from the same vessel.

At least two individuals are presented in the remains from this site sent to Hawaii. Individual descriptions of these remains follows.

Burial SLH-1

A young adult male represented by a calvarium,mandible, and an incomplete infracranial skeleton. The latter is represented by clavicles, humeri, ulnae, femora and patellae, the left radius, fragments of scapulae, hand and foot bones, vertebrae and ribs. Preservation is fair.

Cranial observations

Cranial measurements for this individual are presented in Table 4. Nonmetric observations are recorded in Table 6. Slight pitting, or cribra orbitalia was observed in the roof of both eye sockets. The rocker jaw condition was not observed in the mandible. The cranial vault bones are thick (see Table 8).

Dental observations

Dental measurements for SLH-1 are recorded in Table 7.

The teeth did not show evidence of betel-nut staining. Dental attrition is slight to moderate extending, in some instances, into the dentine. Caries were observed in the molar teeth. The right mandibular third molar is congenitally absent.

Infracranial observations

Measurement of infracranial remains was not permitted. Non-metric observations recorded on the infracranial skeleton are presented in Table 10. Both preclavicular sulci and costal spurring are present on both clavicles. A double septal aperture is present on the left humerus. A Vastus notch was present in the right patella. A medial squatting

facet was observed on the left talus. The anterior and middle articular facets of the right calcaneus took the form of a single facet.

Pathology

Moderate osteoarthritic lipping was observed in the left calcaneus, talus, and navicular bones.

Burial SLH-2

An old-aged female (45+ yrs.) represented by a mandible, some skull fragments, left clavicle, right scapula and patella, first cervical vertebra, and the right first rib.

Cranial observations

A few mandible measurements are recorded in Table 4. Non-metrical observations recorded on the mandible are presented in Table 6.

Dental observations

Tooth measurements for this individual are presented in Table 7. No tooth staining was observed. Dental attrition is moderate to extreme sometimes extending into the pulp cavity. Resorption of the alveolar portion of the mandible is marked.

Infracranial observations

None were permitted.

Pathology

Arthritic lipping and degeneration of the articular surfaces were not observed in these remains.

Non-human and cultural material

Cultural material associated with the burials included sherds of a thick red, coarse tempered pottery and flakes of a chert-like material. Shells, corals, and fish remains were also found.

San Antonio Site (Saipan)

The San Antonio site is located on the southwestern coastal plain of the island of Saipan approximately 300 yards from the lagoon. The site was discovered when construction workers digging a hole for a septic tank cut through a burial pit. Fieldnotes indicate that the burial was covered with a 60 cm. midden layer rich in aboriginal pottery and shell tools. Once through the midden layer a large number of bone fragments that were, with one exception, disarticulated were found. Skulls stacked, one on top of the other, were found at the bottom of the pit. The mandibles were not articulated with any of the crania. In addition to the mass burial there was what appeared to be an extended burial at the edge of the main pit, in a separate sand unit. The legs and feet of this burial were completely articulated.

The mass burial will be described as a separate unit reporting the extent of the cranial and infracranial material examined in the laboratory. The extended burial will be described separately. Included in the description of the mass burial will be the completeness of the remains, minimum number of individuals represented by skulls and long bones, summaries of metric and non-metric observations recorded on cranial, dental, and infracranial remains, a notation of any pathology, and the presence of non-human and cultural material found in association with the human remains.

The Skull

The remains of 14 skulls, in varying states of completeness, are represented in the material from San Antonio. Of the fourteen crania, one is that of a child (approximately 6 yrs. of age), the rest are adults. Very few of the skulls had intact facial skeletons or associated lower jaws. In addition to these partially complete skulls, a large number of complete or partially complete fragments of the major bones of the cranium and lower jaw are present. The minimum number of individuals represented by these bones follows:

	Min. No. of Individuals
Frontal	14
Rt. Temporal	6
Lf. Temporal	16
Occipital	12
Rt. Zygoma	13
Lf. Zygoma	15
Maxillae	20
Mandible	31

The minimum number of individuals represented in the cranial remains from San Antonio falls between twenty-eight (based on the total number of individual frontal bones) and thirty-three (based on separate mandibles or portions of mandibles). Only one individual is a subadult. Examining the degree of dental wear on the teeth of 27 mandibles, fifteen were determined to be young adult (20-30 yrs.), six were middle-aged (30-45 yrs.), and the remaining six were old-aged (45+ yrs.).

Preservation of the cranial remains is generally good to fair. Attempts to reconstruct these remains met with minimum success. The surfaces of all remains were chalky and bleached. Flaking occurs when the bones are handled.

Skull measurements

Individual skull measurements recorded on the most complete adult male and female specimens from the San Antonio site are presented in Table 11. Because of the fragmentary and incomplete nature of the remains, many measurements are missing. The means and standard deviations of cranial measurements for male and female samples are given in Table 12. Cranial indicies are presented in the next table, Table 13.

Male skulls, on the average, are longer but not much broader than female skulls. The cranial index indicates male skulls are long (dolichocranic) while female skulls fall in the upper range of medium- (mesocranic) bordering on broad-shaped crania. The forehead region of both sexes is typically broad (eurymetopic) as measured by the frontal index. Measurements of the eye orbit were recorded on one female specimen; the calculated value for the orbital index indicates wide (or chamaeconchic) orbits. Again, the length and breadth of the maxilla were recorded on a single female specimen. The alveolar index value indicates a broad (brachyuranic) palate. Bifrontal, biorbital, and interorbital breadth measurements are greater in male than female specimens. The same is true of the nasion-bregma, bregma-lambda, and lambda-opisthion chords. There were no female mandible measurements for comparison with those recorded for males.

Later in this report, comparisons of the craniometric data are made with two additional Micronesian samples.

Non-metric cranial observations

Table 14 summarizes the non-metric cranial observations recorded on adult specimens from San Antonio. Because of the small sample,

male and female incidences have been combined and will be reported as such.

The skulls of both sexes are of rugged construction with thick vaults. Male skulls, however, typically display heavier muscle markings, particularly in the occiput region than were found in the female specimens. Plates 8 and 9 show two crania from the San Antonio site.

No cases of metopic suture or persistence of the medio-frontal suture beyond six years of age were observed. However, a trace of this suture, present as a small vertical line in the glabella region, is found in five (5/12) specimens, while in four (33%) it appears as a horizontal ridge. No cases of frontal grooves or spina trochlea were recorded. The supraorbital suture most often is a single notch (12/22 sides). The zygo-facial foramen is double in 8 of the 11 sides examined. Frontal bossing was recorded as bilaterally present in 75% (9/12) of the skulls examined. Brow ridge development for both sexes is minimal. The nasal-frontal suture is omega-shaped in all cases examined. Malar and zygo-maxillary tuberosities and marginal tubercles are generally well marked in the few specimens (4 sides) examined.

(Basal region)

No cases of palatine or maxillary tori were observed. The ovale and spinosum foramina are normal. The anterior condylar canal is single in four sides examined. Precondylar tubercles and ossified apical ligaments in the foramen magnum region were never observe

(Vault)

The parietal foramen is absent in 7 of the 23 sides examined. No cases of coronal or sagittal wormian, or extrasutural, bones were recorded.

PLATE 8.

San Antonio Cranium No. 5
(Adult Female)

A. Frontal view of cranium. Frontal bone lacks brow ridges and displays bilateral bossing. The left zygoma is of robust dimensions.

B. Lateral view, left. Note the well-formed forehead with prominent bossing, H-form pterion, small mastoid process, and well developed mound in occipital region.

a

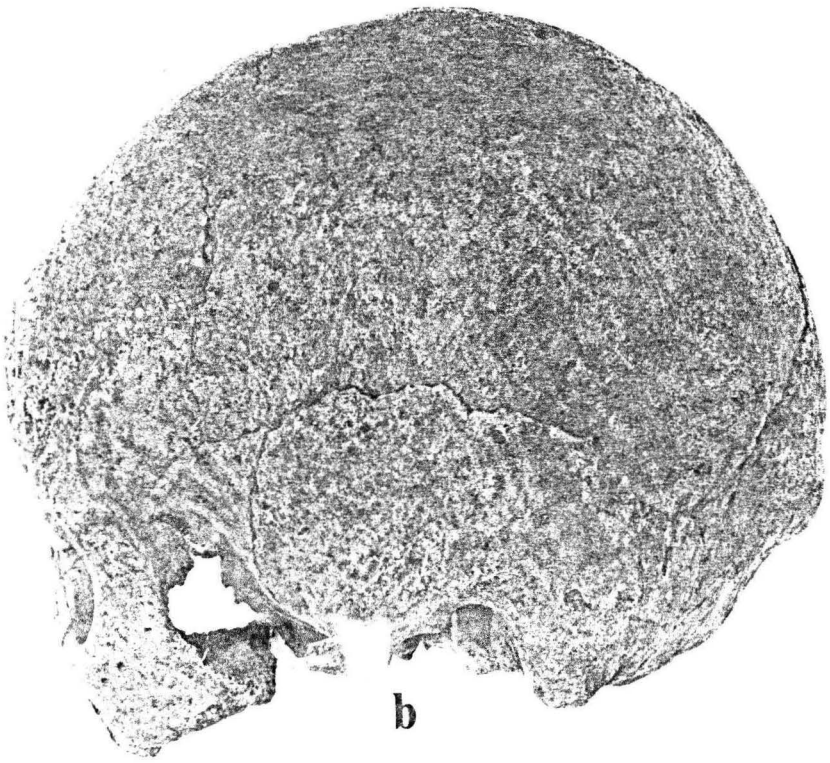

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PLATE 8.

PLATE 9.

San Antonio Cranium No. 6
(Adult Male)

A. Frontal view. The chalky and flaked texture of this specimen masks the well-developed brow ridges of this robust male. A slight depression (trauma before death?) is evident high in the center of the frontal bone.

B. Lateral (left) view. Note well developed mastoid process and inion development.

C. Posterior view. Sandstone encrustations obliterate some of the morphological detail. Note the rugged appearance of the occipital region typical of the cranial material from this site.

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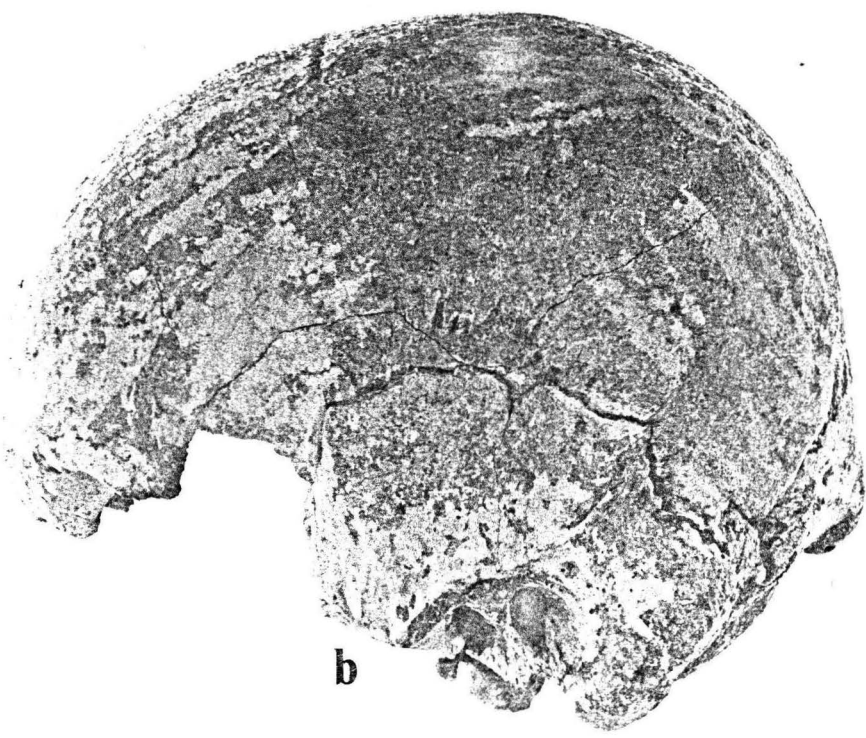

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PLATE 9.

Wormian bones along the course of the lamboidal suture occur in 30% (6/20 sides) of cases examined. A lambdic bone was found in one (n=11) specimen. The form of the vault, when viewed from behind, is haus-form in all specimens. A slight keeling along the sagittal suture was observed in 60% (10 skulls) of the specimens examined. The occiput region shows rugged muscle markings with transverse ridging and inion development being well marked and common. Osteoporosis, or a fine pitting of the orbital roof area, was observed in one specimen.

(Lateral)

The pterion region is typically H-form. Parietal notch and parietal notch bones were never observed; the same is true of asterionic bones. Thickening and dehiscence of the tympanic plate are equally rare being recorded in two and four sides, respectively. Exostoses of the auditory meatus were never recorded in these remains.

(Mandible)

Mandibular torus, multiple mental and/or multiple mandibular foramina and bridging of the mylohyoid groove were never observed in these remains. Partial rocker jaw, or the tendency for the mandible to rock when placed on a flat surface, was observed in 75% or 9 of the 12 mandibles examined. The chin form is most often (58.3%) pointed (median) with a slight inferior angularity at the symphysis menti.

Non-metrical observations of cranial variation are compared with two additional Micronesian samples in a later section of this report.

Skull pathology

Almost without exception, all the adult cranial remains show unusual thickening of the cranial vault. Table 8 contains measurements of cranial vault thickness recorded on 13 crania and 6 vault fragments from San Antonio. Such thickening, or porotic hyperostosis, is not unlike that reported for populations who possess hemoglobinopathies (e.g. sickle cell anemia and thalassemia), which act as balanced polymorphisms maintained by falciparium malaria present in their environment . A similar explanation can be assigned to the cases reported from San Antonio.

Dental Observations

Metric and non-metric observations were recorded on intact maxillary and mandibular dentitions and on a sample of loose teeth from the San Antonio site.

Dental measurements

The means and standard deviations of bucco-lingual (BL) and mesio-distal (MD) crown dimensions for each tooth category are reported in Table 15. The mean cross-sectional area (MD X BL) values in this table were calculated from the means of each tooth measurement. The average summary tooth size value (Brace, 1980: 143) for the San Antonio sample was also calculated from the means of each tooth category: $\sum$ (MD X BL). The San Antonio summary tooth size (1427) exceeds all tooth size figures reported by Brace and Hinton (n.d.) for a number of Pacific (not including Australia) and Asian populations. The only Micronesian sample reported in the latter paper, Guam, has a summary tooth size figure of 1309, well below the San Antonio figure.

Non-metric observations

Non-metric features of the San Antonio teeth are presented in Tables 16 and 17. Plates 10 and 11 show some of the dental variation and pathology present in the San Antonio specimen.

PLATE 10.

San Antonio Mandibles

A. Top view of Mandible No. 1. Note tooth wear on the first molar through incisor region, carious destruction of the left P3, and impaction of right M3.

B. Top view of Mandible No. 7. Damaged specimen showing moderate degree of dental wear and loss of left incisors. The teeth are also stained. The form of the chin is pointed medially.

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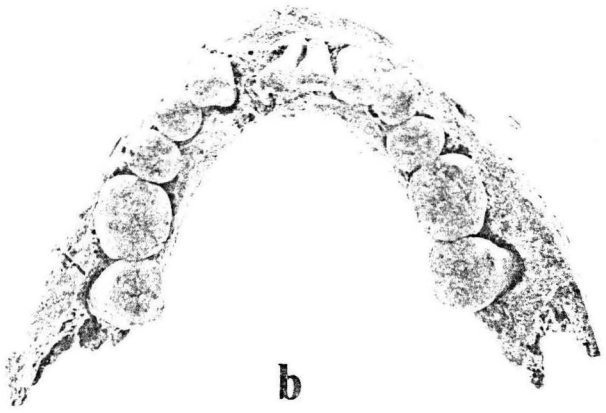

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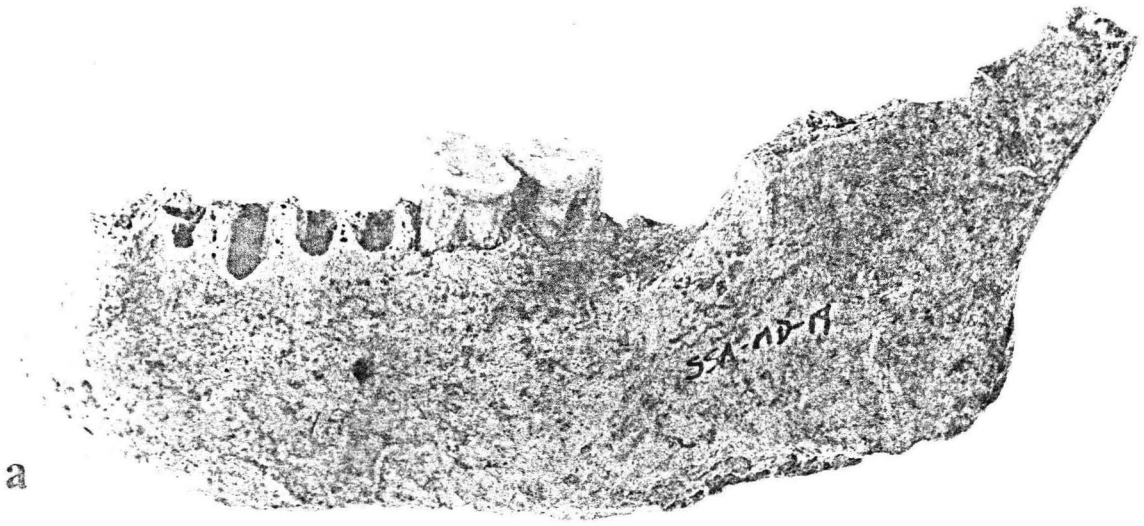
PLATE 10.

PLATE 11.

San Antonio Mandibles

A. Lateral (left) view of Mandible No. 19. Note the excessive tooth wear on the two existing molars, and extensive alveolar bone resorption. The chin form is bilaterally and medially pointed with an angularity rising inferiorly.

B. Lateral (right) view of Mandible No. 24. showing extensive tooth wear of M1 and M2 and resorption of alveolar bone.



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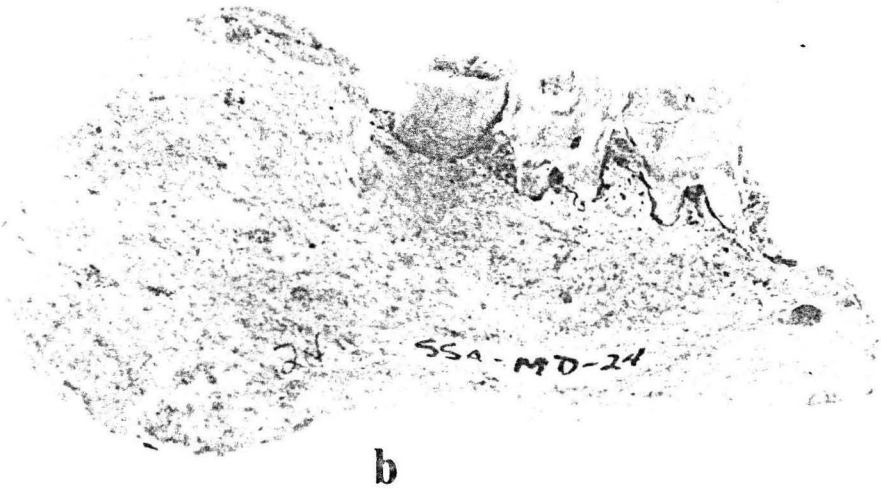

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PLATE 11

(Shovel-shaped incisors)

The frequency of occurrence of shovel-shaped incisors in the San Antonio remains is given in Table 16. Because of the high incidence of post-mortem tooth loss in the maxillary incisor region, excessive attrition, and the fragmentary condition of maxillae in general, these observations are based on a sample of thirteen loose teeth. The majority (76.5%) of incisors show some degree of shovelling.

(Accessory cusps and tooth crown variation)

Table 17 summarizes the frequency of occurrence of some non-metric dental observations recorded on the San Antonio sample. Extension of the crown enamel into the neck region of molar teeth was never observed in these remains. Carabelli's cusp, an accessory cusp most frequently found on the mesial-lingual surface of maxillary first and second molars, is present in four of the twenty-two, or 18.2%, loose upper molars examined. No cases of protostylid, or an accessory distal cusp on mandibular molars, were observed.

(Mandibular molar cusp pattern)

The incidence of lower molar cusp patterns is presented in the same table (Table 17). The most common cusp pattern for the first mandibular molar is 'Y5', while the second molar most frequently displays a '+4' pattern. The third molars are more varied in their cuspid patterns.

(Peg-shaped teeth and tooth filing)

No cases of peg-shaped teeth were observed in these remains. Approximately 57% (n=21) of the maxillary dentitions and 40% (n=96)

of the loose maxillary teeth exhibited what is believed to be culturally induced filing of the labial surfaces of maxillary incisor and canine teeth, which on many specimens exposes the dentine. Similar tooth mutilation of the mandibular teeth was not observed in these remains.

Dental pathology (Tables 18 and 19)

Table 18 summarizes pre-mortem and post-mortem tooth loss and congenital absence of the third molar. With the exception of the incisors, pre-mortem tooth loss is extremely rare. The more frequent loss of maxillary incisors may be attributed to the practice of filing the labial surface of these teeth, thus increasing the likelihood of caries and subsequent tooth loss. Post-mortem loss was extremely high in all but the 1st and 2nd molar teeth, with the highest incidence in the anterior teeth. Congenital absence of the 3rd molar was high, at 42% (n=47).

Other aspects of dental pathology are presented in Table 19. The incidence of caries and abcessing is low. Impaction of the third molar occurs in 10% (n=47) of the specimens examined. Dental attrition is moderate, although the incidence of attrition reaching the root is high for males. Periodontal disease, characterized by resorption of the alveolar bone, calculus build-up, etc. is moderate to marked for both males and females. Most of the specimens exhibited some form of tooth crowding as evidenced by displacement of incisor and canine teeth, and congenital absence and impaction of the third molar.

Comparisons

In this section, limited comparisons are made between the San Antonio cranial sample and two additional samples from the Caroline and Mariana (mainly Tinian and Saipan) Islands. Comparative data were

collected by Pietrusewsky in 1975-78 from museum collections. The material is partly described in Pietrusewsky (1977).

(Cranial measurements)

A comparison of San Antonio male skull measurements with two additional samples from the Marianas and Caroline Islands is presented in Table 20.

Using Student's t-test, more significant ($P < .05$) differences were found between cranial measurements recorded on San Antonio and Caroline skulls (11 out of 16) than between the former and the Mariana sample (8 out of 16). The San Antonio sample registers the greatest dimensions for all sixteen measurements compared. However, due to the small sample size available from San Antonio these findings should be viewed with caution.

(Cranial non-metric observations)

Table 21 compares a number of non-metric cranial traits for the three samples compared above. Chi-square testing (with Yate's correction for small sample size) failed to identify very many significant ($P < .05$) differences between the San Antonio sample and the two Micronesian samples investigated. Again, the relatively small sample representing San Antonio must be taken into consideration when viewing these results.

(Dental metrics)

As mentioned earlier, San Antonio teeth are very large when compared to a number of Pacific samples, including one from Guam, reported in Brace & Hinton (n.d.).

The Infracranial Skeleton

All infracranial bones, except the sternum, are represented in the remains from San Antonio. With the exception of an extended burial, described separately, all of the infracranial bones were disarticulated and mingled. Generally, bone preservation is poor; the distal and proximal extremeties of most of the long bones are either damaged or missing. All remains are highly fragmentary, especially the ribs, vertebrae, innominates, and hand and foot bones, which required extensive sorting and reconstruction. However, despite these attempts, their imperfect preservation and incomplete nature precluded a detailed recording of many observations. Where possible, all remains were sorted out into major bone categories (e.g. humerus, radius, etc.) and where applicable, right and left sides determined.

The minimum number of individuals represented by all the infracranial bones is seventeen.

For purposes of this report, each major bone category will be described to include, where possible, a count of the minimum number of individuals represented, age and sex proportions, metric and nonmetric observations, pathology, and stature estimates.

Presacral vertebrae

Due to the extremely fragmentary condition of the presacral vertebrae, no observations were possible. Very few of these remains could be identified as cervical, thoracic, or lumbar vertebrae. The vast majority consist of unidentifiable fragments.

Sacrum

The remains of five sacral bones represent a minimum of two individuals. Due to the fragmentary condition of these remains no observations were made.

Clavicle

The remains of eighteen bones representing a minimum of nine individuals including at least three males and two females were sorted. Most, if not all of the bones appear to be those of adults. Maximum length measurements of this bone were unable to be recorded. A costo-clavicular sulcus at the site of attachment of the costo-clavicular ligament on the inferior, sternal end of the bone was observed in two of three specimens examined. Spurs of bone at the same location were never observed.

Scapula

Thirty-one scapula fragments representing a minimum of seventeen individuals were found. Most, if not all, of the bones appear to be those of adults. Again, no measurements nor morphological observations were possible due to the fragmentary nature of the remains.

Humerus

The remains of twenty-two bones represent a minimum of twelve individuals including eight males and four females. Most if not all of the bones appear to be those of adults. Measurements and stature estimates for four of the bones follow:

	MALE		FEMALE	
Humerus No.	14	19	7	11
Side	L	L	R	L
Maximum length (mm)	336	352	272	303
Stature (cm)	173.24± 4.25	177.53± 4.25	153.94± 4.25	164.39± 4.25

A septal aperture, or perforation of the olecranon and coronoid fossa of the distal end of the humerus, was observed in one of three specimens examined. No cases of supratrochlear spurring were observed in twelve specimens examined.

Radius

The remains of seven bones represent a minimum of five individuals including three males and two females. Most if not all of the bones appear to be those of adults. Measurements and stature estimates for two of the bones follow :

	MALE	FEMALE
Radius No.	1	6
Side	R	L
Maximum length (mm)	300	245
Head diameter (mm)	29	22
Stature (cm)	188.20± 4.60	168.73± 4.60

Non-metric observations of this bone were not permitted.

Ulna

The remains of fifteen bones represent a minimum of eight individuals including at least four males and three females. Most if not all of the bones appear to be those of adults. No measurements were recorded. Of six bones examined, the presence of an incipiently developed non-articular strip, dividing the olecranon and coronoid process of the trochlear notch, was observed on two. The trochlear notch took the form of an hourglass on three and was continuous on one.

Femur

The remains of twelve bones represent a minimum of eight individuals including at least two males and three females. Most if not all of the bones appear to be those of adults. Measurements and indicies for three bones follow :

	MALE	FEMALE	
Femur No.	12	5	5
Side	L	R	L
Head diameter (mm)	-	45	-
Subtrochantric A-P diameter (mm)	32	25	26
Subtrochantric trans. diam. (mm)	36	31	32
Platymeric Index	88.89	80.65	81.25

The value obtained for the platymeric index indicates no flattening at the subtrochanteric level while the female values for the same index indicate platymeria, or flattening of the femur. Non-metric observations were unable to be recorded on this bone.

Tibia

The remains of thirteen bones represent a minimum of seven individuals. Most if not all of the bones appear to be those of adults. Measurements and indicies for three bones follow :

Tibia No.	8	10	13
Side	L	L	L
Transverse diam. (mm)	26	24	21
A-P diameter (mm)	35	32	31
Platycnemic index	74.28	75.00	67.74

Values for the platycnemic index for tibiae nos. 8 and 10 fall within the eurycnemic range indicating the absence of flattening at the level of the nutrient foramina. The value obtained for tibia no. 13 falls in the mesocnemic range suggesting moderate flattening. Non-metric observations of this bone were not possible.

Patella

The remains of twelve bones represent a minimum of eight individuals. Most if not all of the bones appear to be those of adults. Measurements of seven of the bones follow:

Patella No.	1	2	3	6	9	10	11
Side	R	R	R	R	L	L	L
Height (mm)	45	-	48	48	-	-	-
Width (mm)	45	-	48	48	-	-	-
Thickness (mm)	20	21	21	17	22	20	20

Of seven patella examined, there is no evidence of a Vastus notch, a notch in the supero-lateral surface of the patella. Spurring on the anterior face of the bone was not recorded.

Innominate

A minimum of twelve individuals are represented in the remains of eighteen bones. One is that of a child under seven years of age, the rest appear to be those of adults. A notching of the acetabular notch was observed in two specimens; the total number of observable specimens.

Talus

The remains of sixteen bones represent a minimum of eight individuals. Squatting facets in the neck region of the talus are common being present in six of eight tali examined. Of nine tali examined a medial extension of the trochlear surface into the neck region is characteristic of eight while one possesses both a medial and lateral extension.

Calcaneus

The remains of ten bones represent a minimum of seven individuals including at least one male. Most if not all of the bones appear to be those of adults. Of eight calcanea examined, the anterior and middle

articular facets took the form of an hourglass-shaped process in four, two discrete articular facets in two, and a single facet in one.

Osteoarthritis and pathology

While observations were limited, osteoarthritis and degenerative changes of the major articular surfaces of the infracranial remains were rarely observed. Other pathological involvement of these remains was equally undetectable.

Stature estimates and body proportions

Stature estimates were calculated from the reconstructed lengths of the four humeri and two radii. Estimates of female stature range from approximately 4'11" to 5'8", while male estimates range from about 5'7" to 6'4". In general, the remains of both sexes indicate robust proportions.

Non-human and cultural material

Cultural material found in association with the human remains from San Antonio include sherds of a thick, red, coarse, tempered pottery and flakes of a chert-like material. Shells, corals, and fish bones were also found. A casing for a bullet was also identified.

Extended Burial from San Antonio

An adult female represented by lower extremities only, consisting of fragments of a left patella, right and left tibia, left fibula, and some right and left foot bones. Preservation is poor; all of the proximal and distal extremities of the bones are damaged or missing. Because of the condition of these remains no detailed observations were permitted.

Conclusions

(San Antonio Site)

A minimum of thirty-three individuals are represented in the remains from San Antonio. The majority are adults falling into young, middle-aged, and old-aged adult categories. Of the twelve nearly intact crania, six are male and six are female. All the skeletal and dental remains show unusual robustness but comparisons indicate they are not unlike samples of skulls collected in the Marianas (Tinian and Saipan), Guam, and other Micronesian samples investigated in this report.

Betel-nut staining of teeth, presence of pottery of indigenous origin, and the absence of domesticated animal bones or extensive European trade good items, contribute to establish the pre-contact antiquity of these remains.

(Tinian Latte House Site)

At least six individuals are represented in the remains from this site. Four are female representing divergent age categories from adolescence to old-age. A child and an infant are also represented in these remains. Because of the morphological similarities and sameness of sex, these remains may be familially related.

The skull and long bones of the middle-aged female show classic lesions tentatively diagnosed as yaws (treponemal) infection. Further study of these remains is recommended, which along with a secure chronometric date for the site, will allow a singularly important contribution to the field of paleopathology to be made in the near future.

(Grotto Site)

At least two individuals are represented in the remains from this site, a young adult male and an old-aged female. Because of the fragmentary and limited nature of these remains, their affinities to other Micronesian samples is uncertain. However, the association of sherds of pottery and marine specimens would suggest indigenous affinities.

(Marianas High School)

At least six individuals are represented in the remains from this site. Individuals of different ages (child to old age) and both sexes are included. The presence of betel-nut stained teeth and skeletal and dental similarities with other samples from this island, would suggest these are the remains of the island's indigenous inhabitants.

Finally, cranial vault thickening, or porotoic hyperostosis, was a common observation in the remains from all the sites investigated. This condition has been linked to the presence of malaria and therefore these remains have potential value in studies of hemoglobinopathies of the Pacific in prehistoric times.

Samples Submitted for Radiocarbon Dating

Four samples of bone, approximately 300 grams each, have been submitted for dating to the Radiocarbon Laboratory, Department of Anthropology, University of California at Riverside. The samples sent include:

1. Mass burial from Sa ntonio, Saipan. Bones sacrificed include two femoral shaft fragments (Nos. 1 and 6) and other smaller fragments of femur.

2. Extended burial from San Antonio, Saipan. All the long bones were sacrificed for dating purposes.

3. Tinian site. Two femora from TLH-3 burial were sacrificed.

4. Grotto site. Long bone remains (humerus, radius, ulna, and femur bones from the left side) from SLH-3 burial were sacrificed.

Processing time for obtaining radiocarbon dates is six to nine months.

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Table 1

Skull Measurements Recorded in Study

Measurement Name	Source of Definition
Maximum cranial length	Martin's[1] No. 1
Nasio-occipital length	Martin's No. 1d
Basion-nasion	Martin's No. 5
Basion-bregma	Martin's No. 17
Maximum cranial breadth	Martin's No. 8
Maximum frontal breadth	Martin's No. 10
Minimum frontal breadth	Martin's[2] No. 9
Bistephanic breadth	Howells'[2] STB
Bizygomatic breadth	Martin's No. 45
Biauricular breadth	Martin's No. 11b
Minimum cranial breadth	Martin's No. 14
Biasterionic	Martin's No. 12
Basion-prosthion	Martin's No. 40
Nasion-prosthion	Martin's No. 48
Total facial height	Martin's No. 47
Nasal height	Martin's No. 55
Nasal breadth	Martin's No. 54
Orbital height, left	Martin's No. 52
Orbital breadth, left	Martin's No. 51a
Bijugal breadth	Martin's No. 45(1)
Alveolar length	Martin's No. 60
Alveolar breadth	Martin's No. 61
Mastoid height	Howells' MDL
Mastoid width	Howells' MDB
Bimaxillary breadth	Martin's No. 46
Bifrontal breadth	Martin's No. 43
Biorbital breadth	Howells' EKB
Interorbital breadth	Martin's No. 49a
Malar length, inferior	Howells' IML
Malar length, maximum	Howells' XML
Cheek height	Martin's No. 48(4)
Foramen magnum length	Howells' FOL
Nasion-bregma chord	Martin's No. 29
Bregma-lambda chord	Martin's No. 30
Lambda-opisthion chord	Martin's No. 31
Bimaxillary subtense	Howells' SSS
Nasio-frontal subtense	Howells' NAS
Bigonial diameter	Martin's No. 66
Symphysis height	Martin's No. 69
Ramus height	Martin's No. 70
Ramus breadth	Martin's No. 71a
Mandibular length	Martin's No. 68
Bicondylar width	Martin's No. 47

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Table 2

List of Infracranial Measurements Recorded

Measurement	
1. Clavicle-maximum length	*Martin's No. 1
2. Humerus-maximum length	Martin's No. 1
3. Humeral minimum head diam. (trans)	Martin's No. 9
4. Humeral maximum head diam. (sag.)	Martin's No. 10
5. Ulna-maximum length	Martin's No. 1
6. Radius-maximum length	Martin's No. 1
7. Radial head diameter	Martin's No. 2
8. Femur-maximum length	Martin's No. 1
9. Femoral head diameter-maximum	Martin's No. 15
10. Subtrochanteric ant.-post. diameter	Martin's No. 10
11. Subtrochanteric trans. diameter	Martin's No. 9
12. Femoral mid-shaft diameter (a-p)	Martin's No. 6
13. Femoral mid-shaft (trans.)	Martin's No. 7
14. Tibia-maximum length	Martin's No. 1a
15. Tibia-trans. diameter (nut. for.)	**Wood-Jones #43
16. Tibia-ant-post diameter	Wood-Jones #44
17. Fibula-maximum length	Martin's No. 1
18. Patella height	Martin's No. 1
19. Patella width	Martin's No. 2
20. Patella thickness	Martin's No. 3
21. Lumbar-1 ant. height	Martin's No. 1
22. Lumbar-1 post. height	Martin's No. 2
23. Lumbar-2 ant. height	Martin's No. 1
24. Lumbar-2 post. height	Martin's No. 2
25. Lumbar-3 ant. height	Martin's No. 1
26. Lumbar-3 post. height	Martin's No. 2
27. Lumbar-4 ant. height	Martin's No. 1
28. Lumbar-4 post. height	Martin's No. 2
29. Lumbar-5 ant. height	Martin's No. 1
30. Lumbar-5 post. height	Martin's No. 2

* Martin, R. & K. Saller (1957) Lehrbuch der Anthropologie. Stuttgart: Gustav Fischer.

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Table 3

List of Non-metric Cranial Observations Recorded

Metopic suture
Frontal grooves
Supraorbital structure
Spina trochlea
Infraorbital foramen
Zygo-facial foramen
Infraorbital suture
Multiple ethmoidal foramina
Frontal bossing
Brow ridge development
Orbital shape
Nasal depression
Nasal-frontal suture
Nasal bone shape
Nasal suture deflection
Nasal bone junction
Nasal aperture form
Nasal profile
Subnasal region
Malar tuberosity
Zygo-maxillary tuberosity
Marginal tubercle
Palatine torus
Maxillary torus
Pterygo-bridge
Ovale-spinosum variation
Anterior condylar canal structure
Posterior condylar canal
Occipital condyle
Precondylar structure
Ossified apical
Paramastoid process
Orbital osteoporosis
Parietal foramen
Coronal wormian bones
Bregmatic bone
Sagittal wormian bones
Lambdoidal wormian bones
Os inca
Vault form (posterior)
Sagittal keel
Occiput form
Sagittal suture deflection at bregma
Pterion form
Asterionic bones
Parietal notch (bone)
Tympanic thickening
Tympanic dehiscence
Auditory exostoses
Mandibular torus
Mylohyoid structure
Multiple mandibular foramina
Multiple mental foramina
Rocker jaw
Chin form

Individual Skull Measurements (mm.) of Tinian Latte House, Marianas High School (Saipan), and Grotto (Saipan) Sites

	Tinian Latte House		Marianas HS	Grotto	
Measurement	TLH 1	TLH 2	MHS 1	SLH 1	SLH 2
Cranial length	172	173	175	-	-
Naso-occipital breadth	171	172	174	-	-
Basion-nasion	100	96	-	-	-
Basion-bregma	133	138	-	-	-
Max. cranial breadth	133	130	137	-	-
Max. frontal breadth	109	110	118	112	-
Min. frontal breadth	96	89	-	96	-
Bistephanic breadth	105	108	-	107	-
Bizygomatic	134	128	-	-	-
Biauricular breadth	122	121	-	-	-
Min. Cranial breadth	68	72	-	-	-
Biasterionic	105	103	104	-	-
Basion-prosthian	93	95	-	-	-
Nasion-prosthion	69	70	-	-	-
Nasal height	54	53	-	-	-
Nasal breadth	26	24	-	-	-
Orbital height	36	35	-	-	-
Orbital breadth	43	41	-	-	-
Bijugal breadth	115	112	-	-	-
Alveolar length	47	52	-	-	-
Alveolar breadth	63	64	-	-	-
Mastoid height	29	19	18	-	-
Mastoid width	23	19	16	-	-
Bimaxillary breadth	102	95	-	-	-
Bifrontal breadth	107	100	-	110	-
Biorbital breadth	98	93	-	-	-
Interorbital breadth	27	25	25	-	-

Measurement	Tinian Latte House TLH 1	TLH 2	TLH 4	Marianas HS MHS 1	MHS 2	Grotto SLH 1	SLH 2
Malar length, inferior	33	39	-	-	-	-	-
Malar length, max.	52	58	-	-	-	-	-
Cheek height	22	24	-	-	-	-	-
Foramen magnum length	31	34	-	-	-	-	-
Nasion-bregma chord	108	114	-	109	-	107	
Bregma-lambda chord	107	102	-	110	-	-	-
Lambda-opisthion chord	97	104	-	101	-	-	-
Bimaxillary subtense	21	20	-	-	-	-	-
Nasio-frontal subtense	17	12	-	-	-	-	-
Bigonial diam.	106	97	102	-	-	106	-
Symphsis height	-	33	28	-	30	30	30*
Ramus height	61	50	67	-	77	71	58
Ramus breadth	39	34	41	-	36	37	38
Mandibular length	101	109	104	-	-	-	-
Bicondylar width	126*	119	117*	-	-	-	-

*estimate

Cranial Indices of Tinian Latte House, Marianas High School, and Grotto (Saipan Latte House) Sites

	TLH 1	TLH 2	MHS 1
Cranial Module	146	147	
Cranial index	77.3	79.8	78.3
Height-length index	77.3	79.8	
Height-breadth index	100.0	106.2	
Fronto-parietal index	72.2	68.5	
Nasal index	48.2	44.4	
Orbital index	83.7	85.4	
Maxillo-alveolar index	134.0	123.1	
Gnathic index	107.5	101.1	
Cranial capacity	1286.6cc	1296.2cc	

Table 8

Non-metric Cranial Observations for Latte House (Tinian)[1], Marianas High School (Saipan)[2], & Grotto (Saipan)[3] Sites

Non-metric trait	TLH 1	TLH 2	TLH 3	MHS 1	SLH 1	SLH 2
	Middle-aged female	Young female	Young female	female	Young male?	Middle-aged female?
Facial						
Metopic suture	persistent on brow ridge	absent	absent	absent	horizontal ridge	
Frontal grooves	R- L-[4]	R- L-	L-	R+ L-	R- L-	
R. Supraorbital	double notch	notch	-	notch	slight notch	
L. Supraorbital	notch & for.	notch	notch	-	slight notch	
Spina trochlea	R- L-	R- L-	L-	R- L-	-	
R. Infraorbital for.	double	single	-	-	single	
L. Infraorbital for.	single	single	-	-	single	
R. Zygo-facial for.	single	single	-	-	-	
L. Zygo-facial for.	double	single	double	-	-	
R. Infraorbital suture	R+ L-	R+ L+	-	-	-	
L. Infraorbital suture	R+	-	-	-	-	
Frontal bossing	medial-bilateral	bilateral	bilateral	median	absent	
Brow ridges	slight	absent	absent	absent	slight glabella eminence	
Orbit shape	ellipsoid	equilateral	equilateral	-	-	
Nasal depression	absent	absent	-	-	-	
Nasal-frontal suture	omega	omega	omega	omega	-	
Nasal bone shape	triangle	-	triangle	-	-	
Nasal suture deflect.	to right	-	absent	absent	-	
Nasal-frontal junct.	angle	-	round	-	-	
Nasal aperture	pyriform	pyriform	pyriform	-	-	
Nasal profile	concave	-	straight	-	-	
Subnasal margin	sharp	sharp	blurred	-	-	
R. Malar tuberosity	+[5]	+	-	-	-	
L. Malar tuberosity	+	+	+	-	-	
R. Zygo-max. tub.	++	++	-	-	-	
L. Zygo-max. tub.	++	++	++	-	-	
R. Marginal tub.	++	++	-	-	-	
L. Marginal tub.	++	++	+	-	-	
Orbital osteoporosis	R- L-	R- L-	L-	R-	Slight R+L+	
Basal						
Palatine torus	absent	absent	absent	-	-	
Maxillary torus	absent	absent	absent	-	-	
R. Pterygo-bridge	absent	present	-	-	-	
L. Pterygo-bridge	absent	absent	-	-	-	

Non-metric trait	TLH 1	TLH 2	TLH 3	MHS 1[2]	SLH 1[3]	SLH 2
L. Ant. Condylar canal	single	single	-	-	-	
Post. condylar canal	R1 L1	R1 L1	-	-	-	
Occipital condyles	R1 L1	R1 L1	-	-	-	
Precondylar process	absent	absent	-	-	-	
Ossified apical	absent	absent	-	-	-	
Paramastoid process	R+ L+	R+ L+	-	-	-	
Vault						
R. Parietal for.	single-on	absent	single	double	-	
L. Parietal for.	suture	absent	-	single	-	
R. Coronal wormian bone	absent	absent	-	absent	absent	
L. Coronal wormian bone	absent	absent	-	absent	absent	
Bregmatic bone	absent	absent	-	absent	-	
Sagittal wormian	absent	-	-	absent	-	
L. Lambdoidal wormian	absent	absent	-	-	-	
R. Lambdoidal wormian	absent	absent	-	-	-	
At lambda	absent	absent	-	absent	-	
Vault form	haus-form	haus-form	-	haus-form	-	
Sagittal keel	slight	slight depression	-	absent	-	
Occiput form	mound-ridge-inion	mound-ridge	mound	mound-ridge	-	
Sagittal/breg. deflect.	to left	-	absent	absent	-	
Lateral						
R. Pterion	H-form	H-form	-	-	-	
L. Pterion	H-form	H-form	-	-	-	
R. Parietal notch	absent	absent	-	-	-	
L. Parietal notch	absent	absent	present	-	-	
Asterionic bones	R- L-	R- L-	L-	R- L-	-	
Tympanic thickening	R+ L+	R- L-	L+	R- L-	-	
Tympanic dehiscence	R- L-	R- L-	L-	R- L-	-	
Auditory exostoses	R- L-	R- L-	L-	R- L-	-	

Non-metric trait	TLH 1	TLH 2	TLH 3	TLH 4	SLH 1	SLH 2
Mandible						
Mandibular torus	absent	absent	absent	absent	absent	absent
R. Mylo-hyoid bridge	absent	absent	-	absent	absent	-
L. Mylo-hyoid bridge	absent	absent	-	absent	absent	-
Mult. Mand. for.	R+ L-	R- L-	-	R- L-	R- L-	-
Mult. Mental for.	R- L-	R- L-	L-	R- L-	R- L-	R- L-
Rocker jaw	anterior	anterior	anterior	anterior	absent	anterior
Chin form	median-bilat. angle	median-angle	median-angle	median-bilateral angle	bilateral-angle	median-bilateral angle

Non-metric trait	MHS 1
Mandible	
Mandibular torus	present
R. Mylo-hyoid bridge	-
L. Mylo-hyoid bridge	absent
Mult. Mand. for.	R- L-
Mult. Mental for.	L-
Rocker jaw	anterior
Chin form	median-bilateral angle

[1]TLH=Tinian Latte House site
[2]MHS=Marianas High School site
[3]SLH=Saipan Latte House (Grotto) site
[4]R-L-=trait absent on both sides; R+L-=present on right and absent on left; R-L+=absent on right, present on left; R+L+=present on both sides; R-=absent on right; R+=present on right; L-=absent on left; L+=present on left.
[5]trait scored on a 0(absent); +(slight); ++(medium); +++(marked) basis.

Table 7

Dental Measurements for Tinian Latte House, Grotto (Saipan) and Marianas High School (Saipan) sites.

Burial#	* MD / BL	Maxillary Right M3	M2	M1	P4	P3	C	I2	I1	Maxillary Left I1	I2	C	P3	P4	M1	M2	M3	Mandibular Right M3	M2	M1	P4	P3	C	I2	I1	Mandibular Left I1	I2	C	P3	P4	M1	M2	M3
TLH-1	MD	-	10	10	7	-	-	7	-	9	-	8	-	7	10	10	-	-	12	13	8	-	8	6	-	5	-	-	-	-	-	12	-
	BL	-	11	11	9	-	-	7	-	8	-	8	-	9	11	11	-	-	11	11	9	-	9	7	-	7	-	-	-	-	-	11	-
TLH-2	MD	9	10	11	8	8	8	7	8	8	7	8	8	8	11	11	-	10	11	12	8	8	7	6	6	6	6	7	8	8	12	11	10
	BL	11	11	12	10	10	8	7	7	7	7	7	10	10	12	12	-	9	10	10	8	8	7	7	6	6	7	7	8	8	10	10	9
TLH-3	MD	-	-	12	7	8	9	6	10	10	6	9	8	7	11	-	-	-	-	13	8	8	7	7	6	6	7	7	8	8	13	14	-
	BL	-	-	13	9	10	9	6	8	8	6	9	9	9	13	-	-	-	-	11	8	8	8	7	6	6	7	8	7	8	11	12	-
TLH-4	MD	-	10	11	-	-	-	-	-	-	-	-	-	8	11	10	-	-	-	11	8	8	-	-	-	-	-	-	8	8	-	-	-
	BL	-	11	11	-	-	-	-	-	-	-	-	-	10	11	11		9	-	11	9	8	-	-	-	-	-	-	8	9	-	-	-
SLH-1	MD	-	10	11	8	8	9	8	9	9	8	9	8	7	11	10	9	-	12	13	8	8	8	7	6	6	7	-	8	8	13	12	10
	BL	-	12	12	10	9	9	7	8	8	7	9	9	10	12	12	13	-	11	11	9	9	9	7	7	7	7	-	8	9	11	11	11
SLH-2	MD																	10	11	-	-	-	-	-	-	-	-	-	-	-	-	10	-
	BL																	10	10	-	-	-	-	-	-	-	-	-	-	-	-	10	-
MHS-2	MD																	13	12	12	8	8	8	-	-	-	-	7	8	8	12	12	-
	BL																	11	11	11	9	8	8	-	-	-	-	8	8	9	11	11	-
MHS-3	MD																	12	12	13	8	8	7	-	-	-	-	7	8	8	13	12	-
	BL																	11	11	11	9	9	8	-	-	-	-	8	9	9	11	11	-

*MD=Mesio-distal diameter (mm)

BL=Buccal-lingual diameter (mm)

Skull Thickness Measured at Four Anatomical Points

Site	Glabella	Opisthocranion	Vertex	Euryon
TLH 01	-	-	-	-
TLH 02	-	-	-	-
TLH 03	14.6mm	-	8.15mm	-
TLH 04	-	-	-	-
SSA SK-1	-	5.0mm*	7.0mm*	-
SSA SK-2	20.0mm*	9.0mm*	11.0mm*	-
SSA SK-3	-	7.0mm*	9.0mm*	-
SSA SK-4	-	11.0mm*	-	-
SSA SK-5	-	-	-	-
SSA SK-6	14.0mm*	9.0mm*	-	-
SSA SK-7	-	12.0mm*	-	-
SSA SK-8	-	5.0mm*	8.0mm*	-
SSA SK-9	-	11.0mm*	-	6mm*[1]
SSA SK-10	-	10.0mm*	-	-
SSA SK-11	-	9.0mm*	8.0mm*	-
SSA SK-12	-	10.0mm*	8.5mm*	-
SSA SK-13	15.0mm*	-	7.15mm	-
SSA FR-1	19.0mm*	-	-	-
SSA FR-2	19.35mm	-	-	-
SSA FR-6	20.1mm	-	-	-
SSA FR-12	16.3mm	-	-	-
SSA OC-2	-	6.6mm	-	-
SSA OC-3	-	10.0mm*	-	-
MHS 1	16.0mm*	7.0mm	8.0mm*	-
SLH 1	17.4mm	-	-	-

[1]Average of R & L thickness measurements

*=measurement using hinge caliper; all other measurements made by using sliding caliper.

Table 9

Infracranial Measurements and Indices for Tinian Latte House and Marianas High School Sites -

Measurements (cm)	& Indicies	Burial Number TLH 1	TLH 2	MHS 1
Clavicle length:	R	-	-	-
	L	-	-	-
Humerus length	R	301	291	-
	L	301	293	-
Minimum head	R	39	36	-
diameter	L	39	37	-
Maximum head	R	-	38	-
diameter	L	41	39	-
Ulna length	R	242	239	-
	L	251	-	-
Radius length	R	226	220	-
	L	234	-	-
Radius head	R	22	21	-
diameter	L	21	-	-
Femur length	R	424	419	-
	L	424	416	-
Femur head	R	40	42	44
diameter	L	40	41	-
Subtrochanteric	R	27	26	-
A.-P. diameter	L	26	26	-
Subtrochanteric	R	32	28	-
lateral diameter	L	31	28	-
Platymeric index	R	84.4	92.9	-
	L	83.9	92.9	-
Mid-shaft lateral	R	31	27	-
diameter	L	32	28	-
Mid-shaft A.-P.	R	25	24	-
diameter	L	24	24	-
Pilastric index:	R	80.6	88.9	-
	L	75.0	85.7	-
Tibia length	R	342	344	-
	L	345	346	-
Tibia trans	R	30	23	-
diameter	L	30	23	-
Tibia A.-P.	R	42	32	-
diameter	L	42	31	-
Platycnemic index	R	71.4	71.9	-
	L	71.4	74.2	-
Fibula length	R	-	336	-
	L	-	337	-
Patella height	R	-	40	-
	L	-	39	42
Pa ella width	R	-	43	-
	L	-	43	45
Patella thickness	R	-	18	-
	L	-	19	20
Patella module,L.		-	33.7	-

Table 9 (cont'd)

Measurements (cm) & Indicies	Burial Number TLH 1	TLH 2	MHS 1
Lumbar-1:			
posterior height	-	23	-
anterior height	-	25	-
index	-	92.0	-
Lumbar-2:			
posterior height	-	23	-
anterior height	-	26	-
index	-	88.5	-
Lumbar-3:			
posterior height	-	-	-
anterior height	-	-	-
index	-	-	-
Lumbar-4:			
posterior height	-	-	-
anterior height	-	-	-
index	-	-	-
Lumbar-5:			
posterior height	-	-	-
anterior height	-	-	-
index	-	-	-
Lumbar vertebral index	-	-	-
Radial humerus index	75.1	75.6	-
Intermembral index	68.8	67.0	-
Tibia femur index	80.7	82.1	-
Stature (in cm.)	163.8	163.5	-

Table 10

Non-metric Observations Recorded on the Infracranial Remains from the Tinian Latte House, Marianas High School (Saipan), and Grotto (Saipan Latte House) Sites

Bone	Trait	TLH 1	TLH 2	TLH 3	MHS 1	MHS 2	SLH 1
Sternum	Sternal aperture	-	Absent	-	-	-	-
Clavicle	R. Costo/clavicular sulcus	-	Present	-	-	-	Present
	L.	-	Absent	-	-	-	Present
	R. Costal spur	-	Absent	Absent	-	Absent	Present
	L.	-	Absent	Absent	-	-	Present
Scapula	R. Acromion shape	-	Sickle	-	-	-	-
	L.	-	Sickle	-	-	-	-
	R. Separate epip.	-	Absent	-	-	-	-
	L.	-	Absent	-	-	-	-
	R. Suprascapular	-	-	-	-	-	-
	L.	-	-	-	-	-	-
	R. Vertebral border	-	-	-	-	-	-
	L.	-	-	-	-	-	-
	R. Inferior angle	-	-	-	-	-	-
	L.	-	-	-	-	-	-
Humerus	R. Supratrochlear	Absent	Absent	Absent	-	Absent	Absent
	L.	Absent	Absent	Absent	Absent	-	Absent
	R. Septal aperture	Absent	Absent	Double	-	-	-
	L.	Absent	Absent	Present	-	-	Double
Ulna	R. Ulnar spur	Absent	Absent	-	-	-	-
	L.	Absent	-	-	-	-	-
	R. Trochlear notch	Island	Hour-glass	Island	-	-	Island
	L.	Island	-	-	-	-	-
Radius	R. Radial spur	Absent	Absent	-	-	-	-
	L.	Absent	-	-	-	-	-
Innominate	R. Acetabulum	Pit	-	-	-	--	-
	L.	Pit	-	-	-	-	-
Femur	R. Fossa of Allen	Absent	Absent	-	-	-	-
	L.	Absent	Absent	-	-	-	-
	R. T-3	Ridge	Absent	Absent	-	-	-
	L.	Ridge	Absent	-	-	-	-

Bone	Trait	TLH 1	TLH 2	TLH 3	MHS 1	MHS 2	SLH 1
Patella	R. Vastus notch	-	Absent	Absent	-	-	Present
	L.	-	Absent	-	Absent	-	-
	R. Patellar spurs	-	Absent	Absent	-	-	Absent
	L.	-	Absent	-	Absent	-	-
Tibia	R. Tibial squat. facet	Absent	Present	-	-	-	-
	L.	-	Present	-	-	-	-
Talus	R. Talar extension	-	Medial	-	Medial-Lateral	-	-
	L.	Medial	-	-	Lateral	-	Medial
	R. Talar squat. facet	-	Medial	-	Medial	-	-
	L.	Lateral	-	-	Medial	-	Medial
Calcaneus	R. Calcan. Facet	-	Double	-	Single	-	-
	L.	-	-	-	-	-	Single

Table 11

San Antonio Skull Measurements (in mm.)

	Male Skulls (Cat. No.)								Female Skulls (Cat. No.)					
Measurement	2	6	8	9	10	11	Mandible #1	Mandible #2	1	3	5	7	12	13
Cranial length	192	191	-	193	193	-	-	-	178	175	183	173	181	-
Naso-occipital breadth	188	189	-	189	189	-	-	-	177	174	180	-	-	-
Basion-nasion	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Basion-bregma	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Max. cranial breadth	138	145	146	142	141	133	-	-	143	143	140	-	136	-
Max. frontal breadth	110	121	114	114	120	-	-	-	118	-	115	-	116	-
Min. frontal breadth	97	106	-	100	107	-	-	-	100	95	98	-	98	98
Bistephanic breadth	101	120	111	113	-	110	-	-	-	-	112	-	-	-
Bizygomatic	-	-	-	-	-	-	-	-	-	-	136	-	-	-
Biauricular breadth	127	127	131	141	-	125	-	-	124	128	12	-	-	-
Min. Cranial breadth	84	95*	-	99	-	-	-	-	-	-	78	-	-	-
Biasterionic	110	121	113	128	113	105	-	-	113	111	103	-	113	-
Basion-prosthion	-	-	-	-	-	-	-	-	-	-	-12	-	-	-
Nasion-prosthion	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nasal height	-	-	-	-	-	-	-	-	-	-	49	-	-	-
Nasal breadth	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Orbital height	-	-	-	-	-	-	-	-	-	-	34	-	-	-
Orbital breadth	-	-	-	-	-	-	-	-	-	-	42	-	-	-
Bijugal breadth	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Alveolar length	-	-	-	-	-	-	-	-	-	-	55	-	-	-
Alveolar breadth	-	68	-	-	-	-	-	-	-	-	71	-	-	-
Mastoid height	29	31	25	33	32	25	-	-	22	27	28	-	-	23
Mastoid width	25	26	24	28	25	21	-	-	19	21	21	-	-	20
Bimaxillary breadth	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bifrontal breadth	111	116	-	113	119	-	-	-	-	103	112	-	108	107
Biorbital breadth	98	102	-	99	104	-	-	-	-	89	99	-	-	-
Interorbital breadth	30	28	-	30	32	-	-	-	-	30	27	-	-	28

SSA-SK-4: not measured because of craniostenosis of sagittal suture.

Table 11 (cont'd)

Measurement	Male Skulls (Cat. No.)						Mandible #1	Mandible #2	Female Skulls (Cat. No.)					
	2	6	8	9	10	11			1	3	5	7	12	13
Malar length, inferior	-	-	-	-	-	-	-	-	-	29	35	-	-	-
Malar length, max.	-	-	-	-	-	-	-	-	-	51	51	-	-	-
Cheek height	-	-	-	-	-	-	-	-	-	25	26	-	-	-
Foramen magnum length	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nasion-bregma chord	122	121	-	121	117	-	-	-	-	117	116	-	108*	113
Bregma-lambda chord	117	131	117	118	113	119	-	-	110	113	119	115	109	100
Lambda-opisthion chord	96	91*	94	109	105	-	-	-	-	100	104	99	91	-
Bimaxillary subtense	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nasio-frontal subtense	16	18	-	17	20	-	-	-	-	15	14	-	-	-
Bigonial diam.	-	106	-	-	-	-	106	104	-	-	-	-	-	-
Symphysis height	-	35	-	-	-	-	31	32	-	-	-	-	-	-
Ramus height	-	-	-	-	-	-	60	-	-	-	-	-	-	-
Ramus breadth	-	46	-	-	-	-	43	44	-	-	-	-	-	-
Mandibular length	-	-	-	-	-	-	102	-	-	-	-	-	-	-
Bicondylar width	-	-	-	-	-	-	126	-	-	-	-	-	-	-

*estimate

Summary of Means and Standard Deviations of San Antonio Skull Measurements

	Male			Female		
Cranial Measurement	n	Mean	S.D.	n	Mean	S.D.
Max. cranial length	4	192.25	0.96	5	178.0	4.12
Naso-occipital length	4	188.8	0.50	3	177.0	3.00
Basion-nasion	-	-	-	-	-	-
Basion-bregma	-	-	-	-	-	-
Max. cranial breadth	6	140.8	4.79	4	140.5	3.32
Max. frontal breadth	5	115.8	4.60	3	116.3	1.53
Min. frontal breadth	4	102.5	4.80	5	97.8	1.79
Bistephanic breadth	5	111.0	6.82	-	-	-
Bizygomatic	-	-	-	1	136.0	0.00
Biauricular breadth	5	130.2	6.42	3	126.7	2.31
Min. cranial breadth	3	92.7	7.77	-	-	-
Biasterionic breadth	6	115.0	8.22	4	110.0	4.76
Basion-prosthion	-	-	-	-	-	-
Nasion-prosthion	-	-	-	-	-	-
Nasal height	-	-	-	1	4[illegible]	0.0
Nasal breadth	-	-	-	-	-	-
Orbital height	-	-	-	1	34.0	0.0
Orbital breadth	-	-	-	1	42.0	0.0
Bijugal breadth	-	-	-	-	-	-
Alveolar length	-	-	-	1	55.0	0.0
Alveolar breadth	-	-	-	1	71.0	0.0
Mastoid height	6	29.2	3.49	4	25.0	2.94
Mastoid breadth	6	24.8	2.32	4	20.2	0.96
Bimaxillary breadth	-	-	-	-	-	-
Bifrontal breadth	4	114.7	3.50	4	107.5	3.70
Biorbital breadth	4	100.7	2.75	2	94.0	7.07

Cranial Measurement	Male n	Male Mean	Male S.D.	Female n	Female Mean	Female S.D.
Interorbital breadth	4	30.0	1.63	3	28.3	1.53
Malar length, inferior	-	-	-	2	32.0	4.24
Malar length, max.	-	-	-	2	51.0	0.0
Cheek height	-	-	-	2	25.5	0.71
Foramen magnum length	-	-	-	-	-	-
Nasion-bregma chord	4	120.2	2.22	4	113.5	4.04
Bregma-lambda chord	6	119.2	6.14	6	111.0	6.48
Lambda-opisthion chord	5	99.0	7.65	4	98.5	5.45
Bimaxillary subtense	-	-	-	-	-	-
Naso-frontal subtense	4	17.8	1.71	2	14.5	0.71
Bigonial diameter	3	105.3	1.15	-	-	-
Symphysis height	3	32.7	2.08	-	-	-
Ramus height	1	60.0	0.0	-	-	-
Ramus breadth	3	44.3	1.53	-	-	-
Mandibular length	1	102.0	0.0	-	-	-
Bicondylar width	1	126.0	0.0	-	-	-

Cranial Indices Calculated from Male and Female Mean Skull Measurements[1]

	Male	Female
Cranial Index	73.2 (dolichocranic)	78.9 (mesocranic)
Frontal Index	72.8 (eurymetopic)	69.6 (eurymetopic)
Orbital Index	-	80.9 (chamaeconchic)
Maxillo-alveolar index	-	129 (brachyuranic)
Mandible index	83.6	-

[1]Method of calculation:

Cranial index = Max. cranial breadth ÷ Max. cranial length X 100.

Frontal index = Min. frontal breadth ÷ Max. cranial breadth X 100.

Orbital index = Orbital height ÷ orbital breadth X 100.

Maxillo-alveolar index = Alveolar breadth ÷ Alveolar length X 100.

A Summary of Non-metric Cranial Observations Recorded on Adult San Antonio Specimens (male and female combined)

Trait	N	(n)	%
Metopic suture		(12)	
Absent	3		25.0
Present	0		0.0
Persistent on brow	5		41.7
Horizontal ridge	4		33.3
Frontal grooves			
Per Skull	0/16		0.0
R	0/12		0.0
L	0/14		0.0
Per side	0/26		0.0
Supraorbital (RL)[1]		(22)	
Absent	2		9.1
Single foramen	2		9.1
Double foramen	1		4.5
Single notch	12		54.5
Double notch	0		0.0
Foramen & notch	5		22.7
Spina trochlea			
Per Skull	0/7		0.0
R	0/7		0.0
L	0/7		0.0
RL (per side)	0/14		0.0
Infraorbital (foramen RL)		(1)	
Absent			
One	1		100.0
Two			
Three plus			
Zygo-facial foramen (RL)		(11)	
Absent			
One	3		27.3
Two	8		72.7

Trait	N	(n)	%
Infraorbital suture			
Per skull			
R			
L			
RL (per side)			
Frontal bossing		(12)	
Absent			
Median	3		25.0
Median-bilateral			
Bilateral	9		75.0
Brow ridges		(12)	
Absent	9		75.0
Discontinuous +	1		8.3
Discontinuous ++	2		16.7
Straight +			
+V			
++V			
Orbital shape		(1)	
Equilateral			
Rectangular	1		100
Round			
Trapezoid			
Ellipsoid			
Nasal depression		(3)	
Absent	3		100
Present			
Nasal-frontal suture		(5)	
Round			
Angle			
Flat			
Omega	5		100
Irreg.			
Nasal bone shape			
Rect. angle			
Triangle			
Hour-glass			
Nasal suture deflection		(2)	
Absent	2		100
Right			
Left			

Table 14 (cont'd)

Trait	N	(n)	%
Nasal aperture			
Pyriform			
Heart-shape			
Triangular			
Oval			
Nasal profile		(1)	
Concave	1		100
Convex			
Straight			
Concave-convex			
Convex-concave			
Subnasal		(1)	
Shape			
Blurred	1		100
Groove			
Sulcus			
Malar tuberosity (RL)		(4)	
Absent			
Present	4		100
Zygo-maxillary tub. (RL)		(4)	
Absent			
Present	4		100
Marginal tubercle (RL)		(1)	
Absent			
Present	1		100
Palatine torus		(2)	
Absent	2		100
Present			
Maxillary torus		(2)	
Absent	2		100
Present			
Pterygo- (RL)			
Absent			
Basal			
Basal + for.			
Spin			
Spin + for.			
Nasal-frontal junction		(2)	
Round	1		50.0
Angle	1		50.0
Flat			

Table 14 (cont'd)

Trait	N	(n)	%
Ovale-spinosium (RL)		(3)	
Absent			
Normal	3		100
Common			
Anterior condylar canal (RL)		(4)	
Single	4		100
Divided			
Spurred			
Posterior condylar canal			
Per Skull			
R			
L			
RL			
Occipital cond.			
R1 L1			
Precondylar		(1)	
Absent	1		100
Facet or tubercle			
Ossified apical		(1)	
Absent	1		100
Present			
Paramastoid			
Per Skull			
R			
L			
RL (per side)			
Parietal foramen (RL)		(22)	
Absent	7		31.8
Single	14		63.6
Two			
On suture	1		4.5
Orbital osteoporosis			
Per Skull	1/16		6.2
R	1/14		7.1
L	0/15		0.0
RL	1/29		3.4
Sagittal wormian bone		(10)	
Absent	10		100.0
Present			

Table 14 (cont'd)

Trait	N	(n)	%
Coronal wormian bones (RL)		(21)	
Absent	21		100
Present +			
Bregmatic bone		(10)	
Absent	10		100
Present			
Lambdoidal wormian bone (RL)		(20)	
Absent	14		70.0
Present +	6		30.0
At lambda		(11)	
Absent	10		90.9
Wormian			
Lambdic bone	1		9.1
Os inca			
½ Os inca			
Vault form (post)		(10)	
Haus form	10		100.0
Hayrick			
Round			
Sagittal keel		(10)	
Absent	3		30.0
Present	6		60.0
Depression	1		10.0
Occiput form		(11)	
Mound (M)	1		9.0
Ridge (R)			
Inion (I)			
M-ridge	5		45.5
M-I			
R-I			
MRI	5		45.5
Sagittal/Breg. Deflect		(8)	
Absent	7		87.5
Right			
Left	1		12.5
Pterion (RL)		(3)	
H-form	3		100.0
K-form			
X-form			
epipteric			
other			

Trait	N	(n)	%
Parietal notch (RL)		(14)	
Absent	14		100
Present			
Bone			
Asterionic			
Per Skull	0/9		0.0
R.	0/8		0.0
L.	0/9		0.0
RL (per side)	0/17		0.0
Tympanic thickening			
Per Skull	1/24		41.7
R.	1/10		10.0
L.	1/22		4.5
RL (per side)	2/32		6.2
Tympanic dehiscence			
Per Skull	2/24		8.3
R.	2/10		20.0
L.	2/22		9.1
RL (per side)	4/32		12.5
Auditory exostoses			
Per Skull	0/25		0.0
R.	0/11		0.0
L.	0/23		0.0
RL (per side)	0/34		0.0
Mandibular torus		(12)	
Absent	12		100.0
Present			
Myohyoid		(9)	
Absent	9		100.0
Arch			
Distal			
Arch-distal			
Multiple Mand. for			
Per Skull	0/4		0.0
R.	0/3		0.0
L.	0/4		0.0
RL (per side)	0/7		0.0
Multiple Mental for			
Per Skull	0/12		0.0
R.	0/11		0.0
L.	0/12		0.0
RL (per side)	0/23		0.0

Trait	N	(n)	%
Rocker jaw		(12)	
Absent	3		25.0
Present			
Ant. only	9		75.0
Post. only			
Chin form		(12)	
Median-M			
Bilateral-B			
M-B	1		8.3
Median angle (A)	7		58.3
B-A	2		16.7
MBA	2		16.7
A			

[1](RL)=Frequency of right and left sides combined.

Table 15

Means and Standard Deviations of San Antonio Tooth Measurements

	Mesio-distal			Bucco-lingual			Mean
Maxillary Teeth	n	Mean	S.D.	n	Mean	S.D.	Cross-sectional area[1]
M3	9	9.33	0.87	9	12.00	1.12	111.99
M2	26	10.35	0.74	26	12.54	0.76	129.72
M1	31	11.09	0.79	31	12.49	0.63	138.53
P4	28	7.82	0.67	28	10.25	0.58	80.17
P3	19	8.11	0.32	18	10.17	0.51	82.40
C	27	8.26	0.59	27	9.00	0.62	74.33
I2	14	7.79	0.43	15	7.13	0.64	55.54
I1	14	8.57	0.94	14	7.36	0.63	63.06
Mandibular Teeth							
M3	9	11.89	1.36	11	11.09	1.04	131.86
M2	38	12.32	0.93	38	11.11	0.76	136.77
M1	40	12.83	0.64	40	11.28	0.55	144.60
P4	35	7.94	0.68	35	8.77	0.65	69.67
P3	20	7.95	0.51	20	8.80	0.70	69.96
C	21	7.38	0.50	21	7.91	0.77	58.35
I2	17	6.59	0.51	17	6.71	0.47	44.18
I1	13	5.85	0.38	13	6.15	0.69	35.98

Summary tooth-size[2]=1427

[1]Cross-sectional area=(MDxBL); Brace, 1980:143.

[2]Summary tooth-size figure (Brace, 1980:143) was calculated from mean cross-sectional areas: (MDxBL).

Table 16

Frequency of Occurrence of Shovel-shaped Upper Incisors in San Antonio Remains

	n	Absent N	Absent %	Slight N	Slight %	Marked N	Marked %
Central Incisor	9	0	0.0	0	0.0	9	100.0
Lateral Incisor	8	1	12.5	3	37.5	4	50.0
Total	17	1	5.9	3	17.6	13	76.5

Table 1

Frequency of Occurrence of Some Morphological Features of Texas Antonic Dental Remains

	MALE			FEMALE			?			TOTAL		
	n	N	%	n	N	%	n	N	%	n	N	%
Molar enamel extension												
Mandibular	15	0	0.0	14	0	0.0	1	0	0.0	30	0	0.0
Maxillary	0	0	0.0	1	0	0.0	13	0	0.0	14	0	0.0
Loose	0	0	0.0	0	0	0.0	53	0	0.0	53	0	0.0
Carabelli's cusp												
Maxillary	1	0	0.0	2	0	0.0	13	0	0.0	16	0	0.0
Loose	0	0	0.0	0	0	0.0	22	4	18.2	22	4	18.2
Protostylid												
Mandibular	10	0	0.0	10	0	0.0	1	0	0.0	21	0	0.0
Loose	0	0	0.0	0	0	0.0	16	0	0.0	16	0	0.0
Lower molar cusp pattern												
M1												
+4	11	1	9.1	11	0	0.0	4	0	0.0	26	1	3.8
Y4	11	0	0.0	11	3	27.3	4	0	0.0	26	3	11.5
+5	11	4	36.4	11	2	18.2	4	2	50.0	26	8	30.8
Y5	11	6	54.5	11	6	54.5	4	2	50.0	26	14	53.8
M2												
+4	14	8	57.1	10	7	70.0	8	4	50.0	32	19	59.4
Y4	14	1	7.1	10	2	20.0	8	0	0.0	32	3	9.4
+5	14	0	0.0	10	1	10.0	8	1	12.5	32	2	6.2
Y5	14	2	14.2	10	0	0.0	8	0	0.0	32	2	6.2
Wrinkled	14	0	0.0	10	0	0.0	8	3	37.5	32	3	9.4
+4 & wrinkled	14	2	14.2	10	0	0.0	8	0	0.0	32	2	6.2
Y5 & wrinkled	14	1	7.1	10	0	0.0	8	0	0.0	32	1	3.1
M3												
+4	0	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0
Y4	3	1	33.3	0	0	0.0	0	0	0.0	3	1	33.3
+5	0	0	0.0	0	0	0.0	0	0	0.0	0	0	0.0
Y5	3	1	33.3	0	0	0.0	0	0	0.0	3	1	33.3
Wrinkled	3	1	33.3	0	0	0.0	0	0	0.0	3	1	33.3
Peg-shaped third molar												
Mandibular	10	0	0.0	10	0	0.0	0	0	0.0	20	0	0.0
Maxillary	0	0	0.0	2	0	0.0	7	0	0.0	9	0	0.0
Loose	0	0	0.0	0	0	0.0	13	0	0.0	13	0	0.0

Table 17 (cont'd)

Pre-loaded premolar												
Mandibular	9	0	0.0	13	0	0.0	1	0	0.0	22	0	0.0
Maxillary	0	0	0.0	2	0	0.0	11	0	0.0	13	0	0.0
Loose	0	0	0.0	0	0	0.0	14	0	0.0	14	0	0.0
Tooth filing												
Mandibular	19	0	0.0	19	0	0.0	1	0	0.0	31	0	0.0
Maxillary	1	0	0.0	3	2	66.7	17	10	58.9	21	12	57.1
Loose mand.	0	0	0.0	0	0	0.0	73	0	0.0	73	0	0.0
Loose max.	0	0	0.0	0	0	0.0	96	39	40.6	96	39	40.6

Table 18

Summary of Tooth Loss Found in San Antonio Remains

	Side	Sex	UPPER Postmortem N	%	Premortem N	%	Long. Abs. N	%	LOWER Postmortem N	%	Premortem N	%	Long. Abs N	%	TOTAL UPPER & LOWER Postmortem N	%	Premortem N	%	Long. Abs N	%
Third Molar																				
	R	M	1	0	0.0	0	0.0	1	100.0	11	3	27.3	2	18.2	3	30.0	12	3	25.0	2	16.7	4	33.3
	L	M	1	1	100.0	0	0.0	0	0.0	8	2	25.0	1	12.5	3	42.9	9	3	33.3	1	11.1	3	33.3
	Total	R+L	2	1	50.0	0	0.0	1	50.0	19	5	26.3	3	15.8	6	35.3	21	6	28.6	3	14.3	7	33.3
	R	F	2	0	0.0	1	50.0	1	50.0	7	3	42.9	0	0.0	4	57.1	9	3	33.3	1	11.1	5	55.6
	L	F	1	0	0.0	0	0.0	1	100.0	8	5	62.5	0	0.0	3	60.0	8	3	42.9	0	0.0	4	57.1
	Total	R+L	3	0	0.0	1	33.3	2	66.7	15	8	53.3	0	0.0	7	58.3	17	6	35.3	1	5.9	9	52.9
	R	?	4	0	0.0	0	0.0	1	25.0	1	1	100.0	0	0.0	0	0.0	5	1	20.0	0	0.0	1	20.0
	L	?	5	2	40.0	0	0.0	2	40.0	0	0	0.0	0	0.0	0	0.0	5	2	40.0	0	0.0	2	40.0
	Total	R+L	9	2	22.2	0	0.0	3	33.3	1	1	100.0	0	0.0	0	0.0	10	3	30.0	0	0.0	3	30.0
	Total	R+L	M+F+?18	3	21.4	1	7.1	6	42.9	33	12	36.4	3	9.1	13	41.9	49	15	31.9	4	8.5	19	42.2
Second Molar																							
	R	M	1	0	0.0	0	0.0			13	3	23.1	1	7.7			14	3	21.4	1	7.1		
	L	M	1	0	0.0	0	0.0			10	0	0.0	1	10.0			11	0	0.0	1	9.1		
	Total	R+L	2	0	0.0	0	0.0			23	3	13.0	2	8.7			25	3	12.0	2	8.0		
	R	F	2	0	0.0	0	0.0			12	3	25.0	0	0.0			12	3	25.0	0	0.0		
	L	F	2	0	0.0	0	0.0			10	3	30.0	1	10.0			12	4	33.3	1	8.3		
	Total	R+L	4	0	0.0	0	0.0			22	6	27.3	1	4.5			24	7	29.2	1	4.2		
	R	?	7	1	14.3	0	0.0			1	0	0.0	0	0.0			8	1	12.5	0	0.0		
	L	?	7	2	28.6	0	0.0			0	0	0.0	0	0.0			7	2	28.6	0	0.0		
	Total	R+L	14	3	21.4	0	0.0			1	0	0.0	0	0.0			15	3	20.0	0	0.0		
	Total	R+L	M+F+?20	3	15.0	0	0.0			46	10	22.7	3	6.8			64	13	20.3	3	4.7		
First Molar																							
	R	M	1	0	0.0	0	0.0			13	3	23.1	2	15.4			14	3	21.4	2	14.3		
	L	M	1	0	0.0	1	0.0			11	1	9.1	2	18.2			12	1	8.3	3	25.0		
	Total	R+L	2	0	0.0	1	50.0			24	4	16.7	4	16.7			26	4	15.4	5	19.2		
	R	F	2	0	0.0	0	0.0			10	2	20.0	0	0.0			12	2	16.7	0	0.0		
	L	F	2	0	0.0	0	0.0			10	1	10.0	0	0.0			12	1	8.3	0	0.0		
	Total	R+L	4	0	0.0	0	0.0			20	3	15.0	0	0.0			24	3	12.5	0	0.0		
	R	?	7	4	40.0	0	0.0			1	1	100.0	0	0.0			11	5	45.5	0	0.0		
	L	?	8	2	25.0	0	0.0			0	0	0.0	3	0.0			8	2	0.0	0	0.0		
	Total	R+L	15	6	22.2	0	0.0			1	1	100.0	0	0.0			19	5	26.3	0	0.0		
	Total	R+L	M+F+?24	4	16.7	1	4.2			45	8	17.8	4	8.9			69	12	17.4	5	7.2		
All Molars																							
	Total	R+L	M+F+?68	10	17.2	2	3.4	6	10.3	122	30	24.6	10	8.2	19	10.9	180	40	22.2	12	6.7	19	10.9

	Side	Sex	UPPER Postmortem n	N	%	Premortem N	%	LOWER Postmortem n	N	%	Premortem N	%	TOTAL UPPER & LOWER Postmortem n	N	%	Premortem N	
Second Premolar																	
	R	M	1	0	0.0	0	0.0	12	8	66.7	1	8.3	13	8	61.5	1	7.7
	L	M	1	1	100.0	0	0.0	10	4	40.0	1	10.0	11	5	45.5	1	9.1
Total	R+L	M	2	1	50.0	0	0.0	22	12	54.5	2	9.1	24	13	54.2	2	8.
	R	F	2	1	50.0	0	0.0	10	4	40.0	0	0.0	12	5	41.7	0	0.
	L	F	9	4	44.4	0	0.0	10	2	20.0	0	0.0	19	6	31.6	0	0.
Total	R+L	F	11	5	45.5	0	0.0	20	6	30.0	0	0.0	31	11	33.3	0	0.
	R	?	10	5	50.0	0	0.0	1	0	0.0	0	0.0	11	5	45.4	0	0.
	L	?	9	4	44.4	0	0.0	0	0	0.0	0	0.0	9	4	44.4	0	0.
Total	R+L	?	19	9	47.4	0	0.0	1	0	0.0	0	0.0	20	9	45.0	0	0.
Total	R+L	M+F+?	32	15	46.9	0	0.0	43	18	41.9	2	4.7	75	33	44.0	2	2.
First Premolar																	
	R	M	1	0	0.0	0	0.0	13	10	76.9	1	7.7	14	10	71.4	1	7.
	L	M	1	0	0.0	1	100.0	10	7	70.0	0	0.0	11	7	63.6	1	9.
Total	R+L	M	2	0	0.0	1	50.0	23	17	73.9	1	4.3	25	17	68.0	2	8.
	R	F	2	1	50.0	0	0.0	10	7	70.0	0	0.0	12	8	66.7	0	0.
	L	F	2	2	100.0	0	0.0	10	3	30.0	0	0.0	12	5	41.7	0	0.
Total	R+L	F	4	3	75.0	0	0.0	20	10	50.0	0	0.0	24	13	54.2	0	0.
	R	?	11	6	54.5	0	0.0	1	0	0.0	0	0.0	12	6	50.0	0	0.
	L	?	9	4	44.4	0	0.0	0	0	0.0	0	0.0	9	4	44.4	0	0.
Total	R+L	?	20	10	50.0	0	0.0	1	0	0.0	0	0.0	21	10	47.6	0	0.
Total	R+L	M+F+?	26	13	50.0	1	3.8	44	27	61.4	1	2.3	70	40	57.1	2	2.
All Premolars																	
Total	R+L	M+F+?	58	18	31.0	1	1.7	87	45	51.7	3	3.4	145	73	50.3	4	2.
Canine																	
	R	M	1	0	0.0	0	0.0	13	10	76.9	1	7.7	14	10	71.4	1	7.
	L	M	1	0	0.0	1	100.0	13	10	76.9	0	0.0	14	10	71.4	1	7.
Total	R+L	M	2	0	0.0	1	50.0	26	20	76.9	1	3.8	28	20	71.4	2	7.
	R	F	2	1	50.0	0	0.0	10	7	70.0	0	0.0	12	8	66.7	0	0.
	L	F	2	2	100.0	0	0.0	10	8	80.0	1	8.3	12	10	83.3	0	0.
Total	R+L	F	4	3	75.0	0	0.0	20	15	75.0	1	4.2	24	18	75.0	0	0.
	R	?	11	9	81.8	0	0.0	1	1	100.0	0	0.0	12	10	83.3	0	0.
	L	?	7	3	42.9	0	0.0	0	0	0.0	0	0.0	7	3	42.9	0	0.
Total	R+L	?	18	12	66.7	0	0.0	1	1	100.0	0	0.0	19	13	68.4	0	0.
Total	R+L	M+F+?	24	15	62.5	1	4.2	47	36	76.6	1	2.1	71	51	71.8	1	2.

	Side	Sex	n	N	%	N	%	n	N	%	N	%	n	N	%	N	%
Central Incisor																	
	R	M	1	0	0.0	1	100.0	11	8	72.7	3	27.3	12	8	66.7	4	33.3
	L	M	1	0	0.0	1	100.0	12	7	58.3	4	33.3	13	7	53.8	5	38.5
	Total	R+L M	2	0	0.0	2	100.0	23	15	65.2	7	30.4	25	15	60.0	9	36.0
	R	F	1	1	100.0	0	0.0	10	6	60.0	1	10.0	11	7	63.6	1	9.1
	L	F	1	1	100.0	0	0.0	10	5	50.0	3	30.0	11	6	54.5	3	27.3
	Total	R+L F	2	2	100.0	0	0.0	20	11	55.0	4	20.0	22	13	59.1	4	18.2
	R	?	5	5	100.0	0	0.0	0	0	0.0	0	0.0	5	5	100.0	0	0.0
	L	?	6	5	83.3	1	16.7	0	0	0.0	0	0.0	6	5	83.3	1	16.7
	Total	R+L ?	11	10	90.9	1	9.1	0	0	0.0	0	0.0	11	10	90.9	1	9.1
	Total	R+L M+F+?	15	12	80.0	3	20.0	43	26	60.5	11	25.6	58	38	65.5	14	24.1
Lateral Incisor																	
	R	M	1	0	0.0	0	0.0	11	7	63.6	3	27.3	12	7	58.3	3	25.0
	L	M	1	0	0.0	1	100.0	13	9	69.2	2	15.4	14	9	64.3	3	21.4
	Total	R+L M	2	0	0.0	1	50.0	24	16	66.7	5	20.9	26	16	61.5	6	23.1
	R	F	2	1	50.0	0	0.0	10	7	70.0	0	0.0	12	8	66.7	0	0.0
	L	F	2	2	100.0	0	0.0	9	5	55.6	1	11.0	11	7	63.6	1	9.1
	Total	R+L F	4	3	75.0	0	0.0	19	12	63.2	1	5.3	23	15	65.2	1	4.3
	R	?	9	8	88.9	1	11.1	0	0	0.0	0	0.0	9	8	88.9	1	11.1
	L	?	6	4	66.7	0	0.0	0	0	0.0	0	0.0	6	4	66.7	0	0.0
	Total	R+L ?	15	12	80.0	1	6.7	0	0	0.0	0	0.0	15	12	80.0	1	6.7
	Total	R+L M+F+?	21	15	71.4	2	9.5	43	28	65.1	6	14.0	64	43	67.2	8	12.5
All Incisors																	
	Total	R+L M+F+?	36	27	75.0	5	13.9	86	54	62.8	17	19.8	122	81	66.4	22	18.0

A Summary of Dental Pathology Found in the San Antonio Remains

	Male			Female			Sex ?			Total		
	n	N	%	n	N	%	n	N	%	n	N	%
Periodontal Disease												
Calculus build-up												
Absent	14	11	78.6	18	8	44.4	16	13	81.3	48	32	66.7
Slight	14	3	21.4	18	8	44.4	16	1	6.3	48	12	25.0
Moderate	14	0	0.0	18	2	11.1	16	2	12.5	48	4	8.3
Marked	14	0	0.0	18	0	0.0	16	0	0.0	48	0	0.0
Resorption												
Absent	28	2	7.1	31	0	0.0	27	7	25.9	86	9	10.5
Slight	28	7	25.0	31	4	12.9	27	9	33.3	86	20	23.3
Moderate	28	11	39.3	31	15	48.4	27	5	18.5	86	31	36.0
Marked	28	8	28.6	31	12	38.7	27	6	22.2	86	26	30.2
Rolled rim												
Absent	28	26	92.9	29	27	93.1	22	22	100.0	79	75	94.9
Slight	28	2	7.1	29	2	6.9	22	0	0.0	79	4	5.1
Moderate	28	0	0.0	29	0	0.0	22	0	0.0	79	0	0.0
Marked	28	0	0.0	29	0	0.0	22	0	0.0	79	0	0.0
Caries												
Absent	14	13	92.9	20	17	85.0	20	18	90.0	54	48	88.9
Present	14	1	7.1	20	3	15.0	20	2	10.0	54	6	11.1
Abcesses												
Absent	19	17	89.5	21	18	85.7	21	19	90.5	61	54	88.5
Present	19	2	10.5	21	3	14.3	21	2	9.5	61	7	11.5
Attrition												
Absent	17	0	0.0	22	0	0.0	20	0	0.0	59	0	0.0
Enamel	17	6	35.3	22	6	27.3	20	10	50.0	59	22	37.3
Dentine	17	5	29.4	22	14	63.6	20	10	50.0	59	29	49.2
Pulp	17	0	0.0	22	0	0.0	20	0	0.0	59	0	0.0
Root	17	6	35.3	22	2	9.1	20	0	0.0	59	8	13.5
Impacted third molar												
Absent	20	16	80.0	17	17	100.0	10	9	90.0	47	42	89.4
Present	20	4	20.0	17	0	0.0	10	1	10.0	47	5	10.6

A Comparison of Male Cranial Measurements from the San Antonio Site (Saipan) with Samples from the Caroline and Mariana Islands

	San Antonio			Caroline Islands			Marianas			t-test	
	n	Mean	S.D.[1]	n	Mean	S.D.	n	Mean	S.D.	SA/Car	SA/Mar
Max. Cranial length	4	192.2	0.9	34	178.8	6.0	37	182.4	7.7	4.408*	2.515*
Naso-occipital length	4	188.8	0.5	34	175.0	5.7	37	179.1	7.1	4.782*	2.701*
Max. Cranial breadth	6	140.8	4.8	34	131.0	5.9	37	137.2	5.6	3.837*	1.485
Max. frontal breadth	5	115.8	4.6	34	112.7	5.8	37	114.9	5.6	1.139	0.343
Min. frontal breadth	4	102.5	4.8	34	94.9	4.9	37	96.6	4.0	2.939*	2.750*
Bistephanic breadth	5	111.0	6.8	34	107.1	6.6	37	110.1	6.7	1.230	0.282
Biauricular breadth	5	130.2	6.4	34	119.6	4.3	37	126.3	6.6	4.839*	1.244
Min. Cranial breadth	3	92.7	7.8	34	71.4	3.5	37	73.2	4.2	9.123*	7.279*
Biasterionic breadth	6	115.0	8.2	34	105.5	3.2	37	107.7	4.5	5.094*	3.254*
Mastoid height	6	29.2	3.5	34	27.4	3.0	37	29.0	3.3	1.324	0.137
Mastoid breadth	6	24.8	2.3	34	19.9	2.9	37	20.7	3.1	3.912*	3.091*
Bifrontal breadth	4	114.8	3.5	34	104.1	4.3	37	107.9	3.9	4.775*	3.387*
Biorbital breadth	4	100.8	2.7	34	96.6	3.5	37	98.8	3.3	2.309*	1.166
Interorbital breadth	4	30.0	1.6	34	27.8	2.3	37	28.5	2.8	1.850	1.045
Nasion-bregma chord	4	120.2	2.2	34	109.5	5.3	37	112.9	5.0	3.958*	2.864*
Bregma-lambda chord	6	119.7	6.1	34	114.6	5.9	37	114.9	7.4	1.943	1.504

[1] n=sample size; mean=arithmetic mean; S.D.=standard deviation of mean.

*=t-test significant ($P < .05$); 40 degrees of freedom.

A Comparison of San Antonio Non-metric Cranial Traits with Two Samples[1] from the Caroline and Mariana Islands

	Carolines	Marianas	San Antonio	Chi-square San Antonio/Carolines	Chi-square San Antonio/Maria
Metopic suture	1/34	0/30	0/12	0.303	0.000
	2.9%	0.0%	0.0%		
Frontal grooves (RL)	2/68	6/58	0/26	0.007	1.547
	2.9%	10.3%	0.0%		
Supraorbital:	9/68	7/60	2/11	0.001	0.011
single for. (RL)	13.2%	11.7%	18.2%		
Spina trochlea (RL)	1/68	2/58	0/14	0.775	0.041
	1.5%	3.4%	0.0%		
Infraorbital for.	1/64	10/49	0/1	15.746*	0.574
double (RL)	1.5%	21.9%	0.0%		
Zygo-facial for.	20/63	15/50	8/11	5.058*	5.307*
double (RL)	31.7%	30.0%	72.7%		
Orbital shape:	5/34	7/26	0/1	1.072	0.313
ellipsoidal	14.7%	26.9%	0.0%		
Nasal-frontal suture:	26/29	22/28	5/5	0.010	0.265
omega	89.7%	78.6%	100.0%		
Nasal suture deflection	22/27	21/25	2/2	0.091	0.178
absent	81.5%	84.0%	100.0%		
Nasal bone junction:	5/27	4/26	1/2	0.024	0.075
angled	18.5%	15.4%	50.0%		
Palatine torus present	31/33	26/27	2/2	1.464	2.997
	93.9%	96.3%	100.0%		
Ant. condylar canal	5/68	3/52	0/4	0.202	0.433
divided	7.4%	5.8%	0.0%		
R. Parietal for. absent	7/34	7/28	3/11	0.002	0.068
	20.6%	25.0%	27.3%		
L. Parietal for. absent	11/34	11/28	4/11	0.015	0.039
	32.4%	39.3%	36.4%		
Coronal wormian bones	65/66	60/60	21/21	0.370	0.000
absent (RL)	98.5%	100.0%	100.0%		
Bregmatic bone absent	33/33	30/30	10/10	0.000	0.000
	100.0%	100.0%	100.0%		
Sagittal wormian bones	32/32	23/26	10/10	0.000	0.201
absent	100.0%	88.5%	100.0%		
Lambdoidal wormian	29/66	27/58	6/20	0.540	1.060
bones (RL)	42.4%	46.6%	30.0%		

	Carolines	Marianas	San Antonio	San Antonio/Carolines	San Antonio/Mar
Lambdic bone	0/30	1/29	1/11	0.280	0.007
	0.0%	3.4%	9.1%		
Sagittal-bregma deflection	4/31	0/28	1/8	0.317	0.459
	12.9%	0.0%	12.5%		
Pterion-H-form (RL)	51/63	48/53	3/3	0.005	0.233
	80.9%	90.6%	100.0%		
Epiteric bone (RL)	5/63	3/53	0/3	0.371	0.800
	7.9%	5.7%	0.0%		
Parietal notch (RL)	10/66	8/60	0/14	1.237	0.939
	15.2%	13.3%	0.0%		
Asterionic bone (RL)	16/68	21/60	0/17	3.508	6.512*
	23.5%	35.0%	0.0%		
Tympanic thickening (RL)	13/68	6/60	2/32	1.907	0.048
	19.1%	10.0%	6.3%		
Tympanic dehiscence (RL)	0/67	1/60	4/32	5.801*	2.891
	0.0%	1.7%	12.5%		
Auditory exostoses (RL)	0/68	0/60	0/34	0.000	0.000
	0.0%	0.0%	0.0%		
Mandibular torus absent	17/18	12/12	12/12	0.043	0.000
	94.4%	100.0%	100.0%		
Stylohyoid bridge absent (RL)	36/36	20/22	9/9	0.000	0.017
	100.0%	90.9%	100.0%		
Mult. mand. for. (RL)	0/36	0/22	0/7	0.000	0.000
	0.0%	0.0%	0.0%		
Multiple mental for. (RL)	2/36	4/24	0/23	0.170	2.323
	5.6%	16.7%	0.0%		
Rocker jaw: anterior	12/17	7/10	9/12	0.026	0.048
	70.6%	70.0%	75.0%		
Chin form: median angle	3/18	5/11	7/12	3.906*	0.040
	16.7%	45.5%	58.3%		

[1]Comparative data collected by Pietrusewsky in 1978 from museum collections in Europe.

*Chi-square value significant ($P < .05$); 1 degree of freedom.